

# DISASTER RISK REDUCTION IN BARBADOS

SITUATIONAL ANALYSIS  
2023



## Overview

This report provides an overview of the Situational Analysis of Disaster Risk Reduction efforts in Barbados. It supports the implementation of the Barbados Country Work Programme as well as the design and revision of other critical national instruments to support the implementation of the 2030 Agenda. To this end, the report consolidates risk information for Barbados, establishes the country risk profile, analyses the hazard context, existing vulnerabilities, capacities and gaps to determine the priority areas for action and interventions in support of systemic risk governance.

This document aims to support Caribbean Governments, notably National Disaster Management Organizations, national platforms for disaster risk reduction, and other regional and national institutions, in the design and implementation of national strategies for disaster risk reduction (Country Work Programmes, National Adaptation Plans, other national and sectoral policies, plans and strategies). It also aims to provide an overview of disaster risk reduction for Barbados in order to facilitate exchanges and discussions among different decision-makers and stakeholders aiming to build resilience. The document aims also to contribute to the national implementation of the Early Warnings for All Initiative launched by the United Nations Secretary-General.

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## Equations

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# List of Acronyms

AOSIS	Alliance of Small Island States
AIA	Agricultural Impact Assessments
ARISE	The Global Private Sector Alliance for Disaster Resilient Societies
ARSB	Amateur Radio Society of Barbados
BADMC	Barbados Agricultural Development and Marketing Corporation
BADMCA	Barbados Agricultural Development and Marketing Corporation Act
BCBA	Barbados Citizens Band Association
BERT	Barbados Economic Recovery and Transformation
BFFs	Bridging Fossil Fuels
BGIS	Barbados Government Information Service
BNEP	Barbados National Energy Policy
BPOA	Barbados Programme of Action for the Sustainable Development of Small Island Developing States
BRCS	Barbados Red Cross Society
BSDP	Barbados Sustainable Development Policy
BSS	Barbados Statistical Service
BWA	Barbados Water Authority
CARDI	Caribbean Agricultural Research and Development Institute
CARICHAM	Network of Caribbean Chambers of Commerce
CARICOM	Caribbean Community
CARPHA	Caribbean Public Health Agency
CBC	Caribbean Broadcasting Corporation
CBO	Community Based Organizations
CCA	Climate Change Adaptation
CCCCC	Caribbean Community Climate Change Centre
CCRIF-SPC	Caribbean Catastrophe Risk Insurance Facility – Segregated Portfolio Company
CDB	Caribbean Development Bank
CDEMA	Caribbean Disaster Emergency Management Agency
CDM	Comprehensive Disaster Management
CERO	Central Emergency Relief Organisation
CITES	Convention on International Trade in Endangered Species of Wild Fauna and Flora
COP	Conference of Parties
COVAX	COVID-19 Vaccines Global Access
COVID-19	Coronavirus COVID-19
CRI	Climate Risk Index
CWP	Country Work Programme
CZM	Coastal Zone Management

CZMA	Coastal Zone Management Area
CZMU	Coastal Zone Management Unit
DEM	Department of Emergency Management
DEO	District Emergency Organisations
DRM	Disaster Risk Management
DSRP	Disaster Social Relief Plan
ECA	Eastern Caribbean Area
EFF	Extended Fund Facility
EMAC	Emergency Management Advisory Council
EIA	Environmental Impact Assessments
EPD	Environmental Protection Department
ESIA	Environmental and Social Impact Assessments
FAO	Food and Drug Administration
FAOSTAT	Food and Drug Administration Statistics
FDI	Foreign Direct Investment
FPMR	Folkestone Park and Marine Reserve
GDP	Gross Domestic Product
GEI	Gender Equality Index
GESS	Green Economy Scoping Study
GHSI	Global Health Security Index
GIZ	Deutsche Gesellschaft für Internationale Zusammenarbeit
GoB	Government of Barbados
HDI	Human Development Index
HDR	Human Development Report
HELP	Housing Every Last Person
HIA	Heritage Impact Assessments
ICT	Information and Communications Technology
ICZM	Integrated Coastal Zone Management Plan
IDB	Inter-American Development Bank
IMF	International Monetary Fund
INTEGRARSE	Central American Integration Network for Corporate Social Responsibility
IPCC	Intergovernmental Panel on Climate Change
IUCN	International Union for the Conservation of Nature
JPOI	Johannesburg Declaration and Plan of Implementation
LAC	Latin America and the Caribbean
MAFS	Ministry of Agriculture and Food Security
MER	Monitoring, Evaluation & Reporting
METVT	Ministry of Education, Technological and Vocational Training
MFA	Ministry of Home Affairs and Information

MHEWS	Multi-Hazard Early Warning Systems
MHLR	Ministry of Housing, Lands, and Rural Development
MPEA	Ministry of People Empowerment and Elder Affairs
MPI	Multidimensional Poverty Index
MSI	Mauritius Strategy for the Further Implementation of the Programme of Action for the Sustainable Development of Small Island Developing States
MTDS	Medium Term Growth Development Strategy
NBSAP	National Biodiversity Strategy and Action Plan
NCC	National Conservation Commission
NCDs	Non-Communicable Diseases
NCRIPP	National Coastal Risk Information Planning Platform
NDC	Nationally Determined Contributions
NEMS	National Emergency Management Systems
NEOC	National Emergency Operations Centre
NGO	non-governmental organizations
NHD	National Heritage Department
NMHDMP	National Multi-hazard Disaster Management Plan
NPDP	National Park Development Plan
NSP	National Strategic Plan
OECS	Organization of Eastern Caribbean States
OHR	Organization for Hurricane Relief
PAHO	Pan-American Health Organization
PDP	Physical Development Plan
PWR-ECC	PAHO/WHO Representative to Barbados and the Eastern Caribbean Countries
R2RP	Roof to Reef Programme
RDC	Rural Development Commission
SALISES	Sir Arthur Lewis Institute of Social and Economic Studies
SBRC	Sustainable Barbados Recycling Centre
SCP	Sustainable Consumption and Production
SDG	Sustainable Development Goals
SIDS	Small Island Developing States
SNC	Second National Communications
SRC	Seismic Research Centre
TCDPO	Town & Country Development Planning Office
TIA	Traffic Impact Assessments
ToTs	Training of Trainers
UDC	Urban Development Commission
UNCED	United Nations Conference on Environment and Development
UNCSD	United Nations Commission on Sustainable Development

UNDESA	United Nations Department of Economic and Social Affairs
UNDP	United Nations Development Programme
UNDRR	United Nations Office on Disaster Risk Reduction
UNDRR-ROAMC	United Nations Office for Disaster Risk Reduction for the Americas and the Caribbean
UNECLAC	United Nations Economic Commission for Latin America and the Caribbean
UNEP	United Nations Environment Programme
UNESCO	United Nations Educational, Scientific and Cultural Organization
UNESCO/IOC	International Oceanographic Commission of the United Nations
UNFCCC	United Nations Framework Convention on Climate Change
UNGA	United Nations General Assembly
UNICEF	United Nations Children Fund
UNODC	United Nations Office for Drugs and Crime
UN-ORHLLS	United Nations Office of the High Representative for the Least Developed Countries, Landlocked Developing Countries and Small Island Developing State
UNWOMEN	United Nations Entity for Gender Equality and the Empowerment of Women
USA	United States of America
UWI	University of the West Indies
WB	World Bank
WBPA	Wild Birds Protection Act
WFP	World Food Programme
WHO	World Health Organization
WSSD	World Summit on Sustainable Development

## Barbados At A Glance



<b>Location</b>	13°10' N 59° 32' W
<b>Land Mass</b>	430 km <sup>2</sup>
<b>Climate</b>	Tropical Marine
<b>Population</b>	287, 708 (2021)
<b>Languages</b>	English (official); Barbadian Dialect
<b>Human Development Index</b>	0.790 Rank 70 (2021)
<b>Gender Inequality Index</b>	1.034 Rank 70 (2021)
<b>Global Health Security Index</b>	34.9 Rank 98 (2019)
<b>Climate Risk Index</b>	124 (2017)

# Executive Summary

Disasters represent a problem for development but not of development. They are defined as 'serious disruptions in the functioning of a community or a society causing widespread human, material, economic or environmental losses which exceed the populace's ability to cope whilst utilizing its own resources' (United Nations Office for Disaster Risk Reduction, 2015, p. 17). Disasters are characterized as 'products of the inherit social, economic and political constructs that are distinct from the natural environment' (Wisner, Blaikie, Cannon, & Davis, 2004, p. 4). Noting such, disasters cannot be merely considered as exacerbations of natural hazards. The correlation between natural hazards and disasters can be exemplified in the Risk equation (as seen in Equation 1), whereby a risk represents the probability of harmful consequences, or expected losses (deaths, injuries, property, livelihoods, economic activity disrupted or environment damaged) resulting from interactions between natural or human-induced hazards and vulnerable conditions. Risk is a by-product of the extent of exposure to a hazardous event and the degree of vulnerability to prevailing 'geophysical, biological, social, economic and political conditions' within a given country context (Wisner, Blaikie, Cannon, & Davis, 2004, p. 7). It is pre-determined by endogenous and exogenous factors which have the tendency to increase one's susceptibility to hazards. In instances when disaster occurs, one's adaptive capacity (recognized as the total availability of resources to mitigate risks) is seriously compromised.

## Equation 1: The Risk equation

### **Risk = Hazard × Exposure × Vulnerability**

Disaster risk reduction is one prerequisite to withstand future climatic risks. It calls for knowledge sharing through collaborations at the local, national, regional, and international scales and data collection based on relevant climate information. Small Island Developing States (SIDS) are projected to lose approximately twenty per cent (20%) of their capital stock each year in disasters (United Nations Office of the High Representative for the Least Developed Countries, Landlocked Developing Countries and Small Island Developing States, 2015, p. iv) and the estimated global cost of inaction amounts to five per cent (5%) of their gross domestic product by 2050 (UNORHLLS, 2015; Stern, 2007). Concerted efforts must therefore be taken to avert current and future climatic risks. Inaction on climate change

can lead to enormous costs for the Caribbean region, amounting to over USD\$22 billion annually by 2050 – equalling 10% of the current size of the Caribbean economy (UN-OHRLLS, 2015), and for the case of Barbados, the estimated costs could reach USD\$1 billion a year. High levels of vulnerability and disaster risk call for governments to periodically allocate public spending to adapt, to build resilience and to negate any possible deleterious impacts which could cost billions of dollars or suffer the negative consequences associated with climate change and disasters. Irrespective of the extent of global action taken, it is imperative that SIDS like Barbados utilize the resources available at their disposal whether they may be intra-regionally or extra-regionally sourced; implement country-specific and or localized disaster risk management policies and approaches to enhance resilience; and adopt measures that not only respond to changing global pressures but also consider the needs and concerns of vulnerable and disadvantaged groups.

To support this stance, the Caribbean Community adopted a Comprehensive Disaster Management's Strategy (2014–2024) to promote '*Safer, more resilient and sustainable CDEMA Participating States through Comprehensive Disaster Management*'. This strategy seeks to '*strengthen regional, national and community level capacity for mitigation, management and coordinated response to natural and technological hazards, and the effects of climate change*' via the following four (4) priority outcomes:

- i. Institutional arrangements and capacity at the national and regional levels;
- ii. Information, knowledge management and learning at all levels;
- iii. Planning, coordination and implementation at sectoral levels; and
- iv. Community level concerns and integration within the overall framework for Disaster Management.

Natural hazards will be exacerbated by the impacts of global climate change such as changing trends, variable/changing seasonality and slow onset and extreme events. Recent findings from the Intergovernmental Panel on Climate Change's (IPCC) Fifth Assessment Report (AR5) (2013) indicate that there will be an increase in the intensity of natural phenomena impacting the Caribbean region – particularly from tropical cyclones. This evidence has been reaffirmed in the IPCC's Sixth Assessment

Report (AR6) which states that:

*"Human-induced climate change is already affecting many weather and climate extremes in every region across the globe. Evidence of observed changes in extremes such as heatwaves, heavy precipitation, droughts, and tropical cyclones, and, in particular, their attribution to human influence, has strengthened since AR5," (IPCC, 2021).*

Such occurrences, coupled with ineffective fiscal measures to avert risks and to reduce exposure will pose detrimental effects on the standard of living, level of commerce and the extent of biodiversity and ultimately, the quantity and quality of ecosystem services within the region. Inevitably, this will lead to severe disruptions within key socio-economic sectors such as tourism, agriculture, and fisheries – the lifeblood of the Caribbean people. It should be noted that these socio-economic activities tend to occur in large settlements on or near the coastline (UNFCCC, 2007, p. 24). Even though the region continues to grapple with a myriad of challenges based on climatic and non-climatic factors, the degree to which each characteristic is exemplified is dependent on the prevailing economic, social, and environmental conditions within a given country context.

This report provides an overview of the Situational Analysis of Disaster Risk Reduction efforts in Barbados. It supports the implementation of the Barbados Country Work Programme as well as the design and revision of other critical national instruments. These include the National Adaptation Plan, Medium and Long-Term (National) Development Strategies, sectorial policies, strategies and plans, and other supporting national instruments to support the implementation of the 2030 Agenda. To this end, the report consolidates risk information for Barbados, establishes the country risk profile, analyses the hazard context, existing vulnerabilities, capacities and gaps to determine the priority areas for action and interventions in support of systemic risk governance.

Key findings of the study have revealed that even though Barbados is generally regarded as an outlier within the Caribbean Archipelago, the island has been subjected to an array of intra-island and inter-island hazards to varying degrees. Such hazards stem from either a hydrometeorological, geological, environmental, chemical, biological, technological and societal basis. In particular, the direct costs, indirect costs and secondary effects associated

with the incidence of hydrometeorological hazards has intensified in recent times. This was particularly observed within the national risk landscape during the passage of Hurricane Elsa in July 2021.

The prevalence of budgetary constraints, weak institutional capacities, limitations in technical expertise and a general paucity of knowledge and coordination of effective disaster preparedness and disaster response measures limit the society's adaptive capacity. This in turn highlights pre-existing and potential vulnerabilities within the Barbadian context such as fragility, susceptibility or lack of resilience within and across sectors and associated with cross-cutting issues like water, energy and waste. Such vulnerabilities stem from either social, economic, physical, environmental, political, ideological, educational and institutional bases. Ultimately, food, water and energy insecurities pose significant challenges for the island. In addition to this, several underlying factors aggravate exposure and vulnerability to hazards thereby further exacerbating the country's risk profile. These include poverty, land degradation, unregulated development practices and conflicts.

Economic losses resulting from disaster impacts compromise the development gains achieved thus far on the island. In some instances, Barbados has sought disaster relief from external entities like the Caribbean Catastrophe Risk Insurance Facility because the island's exceedingly high level of indebtedness has precluded it from various tranches of developmental assistance – a necessary requirement to effectively address developmental concerns such as adaptation, mitigation and loss and damage. Disasters affecting the island have also resulted in several human and social impacts. These include injury, loss of life, the derailment of livelihoods and extensive damage to capital and productive assets. The extent of such impacts has emphasized the growing need for climate finance, national building codes and greater investments in renewable energy.

The extent of synergies in policy coherence on the national and international scales particularly across the strategic, conceptual and operational dimensions emphasizes Barbados' high degree of political will and transformational thinking. Even with this heightened awareness of hazards and disaster risks (whether climate-related or man-made) at the national level, there needs to be a demonstrated level of political will at the international level to address the consequences of disaster risk – particularly within the SIDS context regarding adaptation,

mitigation and loss and damage. The existence of overarching policies which are aligned with sectoral coordination and initiatives across various thematic areas reaffirms the island's commitment to achieve the desired goals and objectives over the short, medium and long terms. The adoption of a bottom-up approach in addressing disaster risk on the island also highlights the important role of society in the national context to address current disaster risks and hence minimize future risks and associated impacts.

Despite the interventions made at the national level to support disaster risk reduction efforts, gaps still exist within the National Disaster Management Framework. Current institutional arrangements are associated with unenforced building codes, the lack of an existing legislative authority to oversee the development and finalization of such codes as well as a paucity of technical and financial resources to monitor and enforce the building codes when they are approved. Similarly, there is limited legislative, sectoral and policy frameworks governing climate change, adaptation and in particular disaster risk management to support the national Comprehensive Disaster Management policy.

Inadequacies within sectoral mainstreaming stem from business continuity plans and insufficient investments - particularly in the limited implementation of the Pan American Health Organization SMART hospital program. Despite the wide extent of community engagements, there is limited data sharing and exchanges across the Multi-Hazard Early Warning Systems (MHEWS) community. Similarly, there is no local governance mechanism to support disaster risk reduction efforts. In terms of knowledge management, there is no national database to record disaster losses nor a nationally designated authority to facilitate integrated hazard modelling processes. There is also a lack of a standardized reporting format for the island's multi-hazard risk as well as existing technical complexities and limitations in the tailoring of information for various end users. It is imperative that a small vulnerable economy like Barbados 'builds back better' in its recovery, rehabilitation and reconstruction efforts. This therefore poses implications for the island's current capacity for response, recovery and rehabilitation for resilience – particularly within its pre-disaster and post-disaster recovery processes. The island's pre-disaster processes are limited by functionality and the lack of integrated decisions, support platforms and tools to support sector-specific and cross-sectoral impacts-based forecasting

and research. Similarly, post-disaster processes are highly ineffective with limitations in response to ensure a full return to normalcy. There is a lack of revitalization for affected sectors and a lack of prioritization of the Government's Contingency Continuity Plan and the Business Continuity Plans. In particular, there is a lack of alignment of key sectors to support business continuity plans. This emphasizes the urgent need to enhance the national recovery framework, considering economic, social, environmental and infrastructural dimensions of recovery and to strengthen public-private sector partnerships.

# Priority Areas for the Implementation of the Barbados Country Work Programme

## Programme Area 1 – Institutional Strengthening for Comprehensive Disaster Management

### ✓ Outcome 1.1 Strengthened enabling environment for Comprehensive Disaster Management

- Output 1.1.1 CDM integrated into national policy and legislation.
- Output 1.1.2 National Emergency Management System (NEMS) strengthened for effective implementation monitoring and reporting.
- Output 1.1.3 National DRM Programme adequately funded

### ✓ Outcome 1.2 Resilient Critical Infrastructure

- Output 1.2.1 Appropriately equipped DEM Headquarters building that is purpose-built to withstand multi-hazard impacts
- Output 1.2.2 Critical Infrastructure (CI) Assessment and Audit Programme implemented

## Programme Area 2 – Preparedness Response and Mitigation Capacity

### ✓ Outcome 2.1 Operational readiness enhanced

- Output 2.1.1 National Multi-Hazard Disaster Management Plan and related procedures updated and approved
- Output 2.1.2 Training and Exercising Programme strengthened
- Output 2.1.3 Communications and EWS improved
- Output 2.1.4 Operation component of the Sub Regional Foal Point enhanced

### ✓ Outcome 2.2 CDM mainstreamed into key sectors

- Output 2.2.1 DRM Strategies established for key sectors

## Programme Area 3 - Strengthening Community Resilience

### ✓ Outcome 3.1 Strengthened community mitigation, preparedness and response

- Output 3.1.1 Community Based Early Warning System established in vulnerable communities
- Output 3.1.2 Community-based Disaster Management Programme strengthened for vulnerable groups

### ✓ Outcome 3.2 Community livelihoods sustained through effective risk management

- Output 3.2.1 Risk Catastrophe Insurance Mechanisms established and implemented for vulnerable groups
- Output 3.2.2 Social Protection Programmes strengthened

## Programme Area 4 - Research and Knowledge Management

### √ Outcome 4.1 Risk informed development planning, regulations and decision making

- Output 4.1.1 Risk assessment enhanced through hazard monitoring, forecasting and mapping
- Output 4.1.2 National repository for hazard knowledge improved

### √ Outcome 4.2 Learning for CDM enhanced

- Output 4.2.1 DRM integrated into the curriculum of education institutions
- Output 4.2.2 DRM education, training, and knowledge sharing opportunities available to the NEMS
- Output 4.2.3 Public Awareness Programme strengthened

## Programme Area 5 - Recovery

### √ Outcome 5.1 Enhanced National Recovery Framework

- Output 5.1.1 Continuity of Government arrangement established
- Output 5.1.2 Business Continuity Planning (BCP) for key sectors established
- Output 5.1.3 Policy and procedures for ex ante disaster recovery planning
- Output 5.1.4 Psychological Support Programme strengthened

# Disaster Impacts for Barbados

## Chapter 1 Overview

This chapter provides a historical context of hazards and disasters affecting Barbados in terms of their economic, social, environmental and geopolitical implications. It also assesses the economic consequences of such phenomena.

Economic losses resulting from disaster impacts tend to compromise the development gains achieved thus far. In some instances, the island of Barbados has sought disaster relief from external entities. Such action was warranted because of the existence of significant budgetary constraints at the national level.

Disasters affecting the island have also resulted in several human and social impacts. These include injury, loss of life, the derailment of livelihoods and extensive damage to capital and productive assets. The extent of such impacts has emphasized the growing need for climate finance, national building codes and greater investments in renewable energy.

As one of the most densely populated countries in the Western Hemisphere, socio-demographic characteristics across Barbados highlight the existence of competing demands on housing, healthcare, transportation, food, water, energy, telecommunications and sanitation. These can pose negative implications to citizen security on the island if not adequately addressed and rectified.

## 1. Introduction

The Third United Nations Conference on Disaster Risk Reduction in 2015, saw the adoption of the Sendai Framework for Disaster Risk Reduction 2015-2030. The Framework recognizes that disaster risk reduction is essential to the achievement of sustainable development. Target E of the Framework aims to “substantially increase the number of countries with national and local disaster risk reduction strategies by 2020.” The disaster risk reduction strategy forms the roadmap for targeted activities over the medium term in support of disaster risk reduction. For Participating States of the Caribbean Disaster and Emergency Management Agency (CDEMA), these are referred to as Country Work Programmes. The Country Work Programme sets out the short, medium, and long term results to be achieved in disaster risk reduction and prescribes a monitoring framework for measuring progress.

This study seeks to inform the implementation of the recently approved Country Work Programme for Barbados, as well as the design and revisions of other critical national instruments including the National Adaptation Plan, Medium and Long-Term (National) Development Strategies, sectoral policies, strategies and plans, and other supporting national instruments for the implementation of the 2030 Agenda. The report serves as a compendium of risk information for Barbados; establishes the country risk profile; analyses the hazard context; and identifies existing vulnerabilities, capacities, and gaps to determine the priority areas for action and interventions in support of systemic risk governance. The review and recommendations will therefore be of particular interest to the stakeholders at the national, subnational, regional and global levels, including state and sectoral entities, private sector organizations, academia, donor agencies, civil society organizations, and other stakeholders interested in understanding the risk environment for Barbados in support of targeted interventions.

## 1.1 Human and Social Impact of Disasters

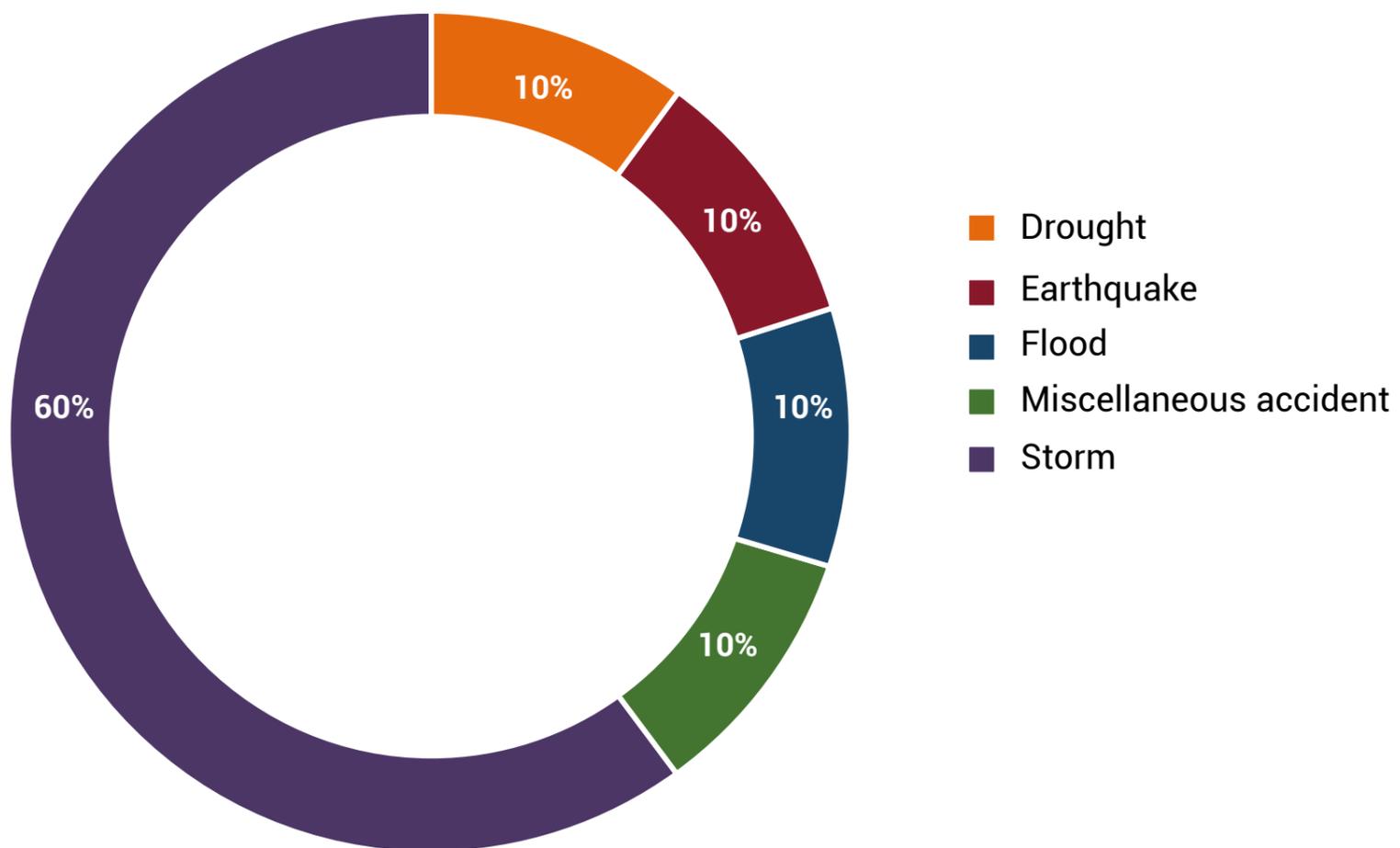
The COVID-19 pandemic created unprecedented challenges on the national front and over-emphasized the underlying causes of vulnerability across different dimensions<sup>1</sup>. Barbados recorded its first two confirmed cases of COVID-19 on March 17th, 2020. The COVID-19 pandemic resulted in significant losses to human life and well-being, disrupting livelihoods and exacerbating underlying vulnerabilities such as poverty and inequality. As of December 12th, 2022, Barbados recorded 528 mortalities as a result of COVID-19 Coronavirus.

Barbados is subjected to an array of intra-island and inter-island hazards to varying degrees. According to the World Bank’s Climate Change Knowledge Platform, the average annual natural hazard occurrence for Barbados<sup>2</sup> (as seen in Figure 1) over the period 1980-2020 includes: droughts (10%); earthquakes (10%); floods (10%); miscellaneous accidents (10%) and storms (60%), (World Bank, 2022).

<sup>1</sup> UNDRR. 2022. ‘Terminology – Vulnerability’. <https://www.undrr.org/terminology/vulnerability>. Different facets of vulnerability include social, economic, physical and environmental vulnerabilities and will be discussed further in Section 2.2.

<sup>2</sup> The World Bank. 2022. “Climate Change Knowledge Portal: Country profile - Barbados”. <https://climateknowledgeportal.worldbank.org/country/barbados/vulnerability>

Figure 1: The Average Annual Natural Hazard Occurrence for Barbados (1980-2020)



Source: The World Bank's Climate Change Knowledge Portal, 2022

In most instances, the progression of a hydrometeorological system towards Barbados is usually classified as a tropical storm – a weaker hydro-meteorological system in terms of its associated effects. However, the economies of Antigua and Barbuda, Dominica, Grenada, and Jamaica often experience intensified hydrometeorological elements associated with tropical cyclones. In recent times, the human and social impacts of disasters in Barbados have increased. During the last century, Barbados has been hit by six systems - the most devastating being Hurricane Janet in 1955 which killed 38 people, destroyed 8,000 homes, and left approximately 20,000 residents homeless.

During July 2021, the island experienced its first Category 1 System: Hurricane Elsa in over 65 years. Even though the nature of the housing stock has drastically changed, the direct costs, indirect costs, and cumulative effects previously associated with the aftermath of Hurricane Janet in 1955 were still apparent. This emphasized the growing need for climate finance, national building codes and greater investments in renewable energy. Table 1 highlights the historical hazard impacts in Barbados over the period 1949-2021.

**Table 1: Historic Hazard Impacts in Barbados**

Date	Hazard	Lives Lost	Persons Affected	Economic Losses US'000	Main Sectors Affected
Aug 1949	Flood	41			
Sept 1955	Hurricane Janet (Cat.3)	38	29,000 8,000 homes		Housing
Sept 1963	Hurricane Edith				Infrastructure (roads, bridges), fishing, agriculture (soil erosion), electricity, communications
Oct 1970	Floods	3	200	500	infrastructure (buildings, roads, bridges); fisheries; agriculture (soil erosion); electricity; water and telecommunications
Jul 1980	Hurricane Allen (Category 3)	7	5007 affected (5000 homeless)	1500	Fishing, poultry, housing
Oct 1984	Floods		100	2,000	Infrastructure
Sept 1987	Tropical Storm (Emily)		230	100,000	Infrastructure; fisheries; agriculture (soil erosion); electricity;
Aug 1995	Floods	1		5,000	
Sept 1995	Tropical Storm (Marilyn)				Infrastructure; fisheries; agriculture (soil erosion); electricity; water and telecommunications
Sept 2002	Tropical Storm (Lili)		2,000 affected (2000 homeless)	200	infrastructure (buildings, roads, bridges); fisheries; agriculture (soil erosion); electricity; water and telecommunications
Sept 2004	Tropical Storm (Ivan)	1	880 homeless	5,000	Coastal erosion, housing
Nov 2007	Earthquake 7.4	0	1		
Jan 2010	Drought				Agriculture, water distribution
Oct 2010	Tropical Storm (Tomás)		2,500	37,000	Housing, electricity, water
Sept 2017	Hurricane Irma	1			Infrastructure; fisheries; agriculture (soil erosion); electricity; water and telecommunications
March 2020 - present	COVID-19 pandemic			200,000	Tourism and hospitality; construction; small business; education; social
April 2021	Ashfall		287, 708		Infrastructure; agriculture (soil erosion), electricity, communications, housing, water
Sept 2021	Hurricane Elsa (Category 1)	0	3114 <sup>3</sup> affected; 186 homeless 3300 total affected <sup>4</sup>	n.a <sup>5</sup>	Housing, Electricity, Water Distribution, Communications, Infrastructure

Source: The Department of Emergency Management; EM-DAT International Database for Disasters; The Barbados Meteorological Services; The Barbados Museum

3 BGIS. 2021. "DEM Reports On Damage From Hurricane Elsa ". <https://gisbarbados.gov.bb/blog/dem-reports-on-damage-from-hurricane-elsa/>. Initially, the Department of Emergency Management noted that 2,372 problems reported: (1,333 reports of roof damage; 326 reports of other house damage; 145 reports of total house collapse)

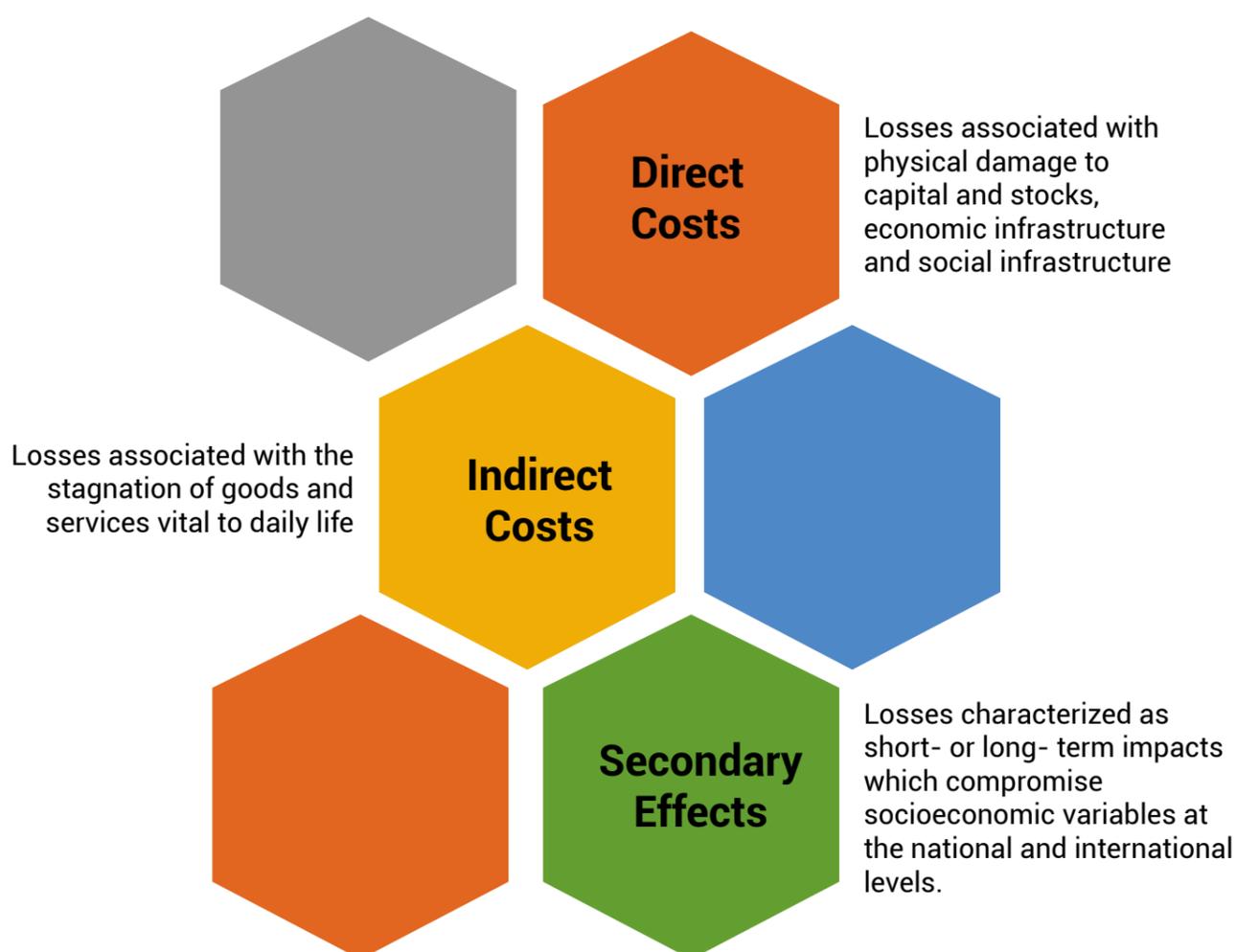
4 EM-DAT. 2022 "Custom Request for types of hazards affecting Barbados".

5 At the timing of this study, the final figure on the extent of the damage associated with the passage of Hurricane Elsa was not readily available.

## 1.2 Economic Impact of Disasters

Natural hazards are exacerbated by the impacts of climate change such as changing trends, variable/ changing seasonality and slow onset and extreme events. During July 2021, Barbados experienced its first Category 1 System: Hurricane Elsa<sup>6</sup> in over 65 years<sup>7</sup>. Natural hazards such as tropical cyclones represent an existential threat to the lives and livelihoods of the Caribbean community. Such events have the tendency to compromise development gains achieved thus far through the perpetuation of poverty, infrastructural damage, degradation of natural resources, derailment of livelihoods and loss of life. It should be noted that the degree to which these factors are exemplified and translated into direct and indirect economic costs as well as secondary effects (as seen in Figure 2) is dependent on the prevailing economic, social, and environmental conditions within a given country context. Similarly, the current trajectory of tropical cyclones and their rate of transition from tropical storms may increase a country's susceptibility. This is due to the intensification of the phenomenon by rising sea surface temperatures. As a result, some economies may be affected to a larger extent than others as they grapple with stronger winds speeds and other associated effects.

**Figure 2: The Economic Impact of Disasters**



Source: Author's adaptation of (United Nations Development Programme, 2004, p. 12)

Since October 2010, the island of Barbados has received seven (7) substantive payments totalling USD\$ \$21,774,135.00 (BBD \$43,548,270.00) - representative of 8.9% all CCRIF pay-outs since the inception of the multi-country risk pool mechanism in 2007. The following Boxes (Boxes 1, 2 and 3) provide an overview of the economic consequences of disasters in Barbados and underscore the importance of budgetary allocations to facilitate disaster risk management.

6 BGIS. 2021. 'Elsa Now Beginning But Is A Dangerous Storm'. <https://gisbarbados.gov.bb/blog/met-office-elsa-now-beginning-but-is-a-dangerous-storm/v>

7 Barbados Today. 2021. 'Elsa is the First Hurricane to hit Barbados in 65 years'. <https://barbadostoday.bb/2021/07/02/elsa-is-the-first-hurricane-to-hit-barbados-in-65-years/>. At the timing of this study, the final figure on the extent of the damage associated with the passage of Hurricane Elsa was not readily available.

## Box 1 - Caribbean Catastrophe Risk Insurance Facility's (CCRIF) Payments to Barbados

**Project summary:** Launched in 2007, this mechanism acts a regional catastrophe fund for Caribbean and Central American governments tasked to limit the financial burden posed by the occurrence of natural hazards such as earthquakes, tropical cyclones, and excessive rainfall, thereby mitigating the inherit short term cash flow problems experienced by small developing economies - particularly in stances following significant catastrophic events. The mechanism also aids its recipients by financing their initial disaster response as well as maintaining basic government functions. Nineteen (19) Caribbean and Central American governments are currently granted access to the funds within this mechanism with the total CCRIF payments to date on tropical cyclone, earthquake and excess rainfall policies amounting to USD\$138,815,479 or BBD \$277,630,958 (as seen in Figure B1.1).

**Coordinating bodies:** The World Bank, the Caribbean Development Bank, Government of Canada, through the Department of Foreign Affairs, Trade and Development; the United States, through the Department of the Treasury; the European Union, through the European Commission, and Germany, through the Federal Ministry for Economic Cooperation and Development the European Union, The Department for International Development (UK) and the Governments of France, Ireland, Bermuda, and Mexico.

**Aim:** To limit the financial burden posed by the occurrence of natural hazards such as earthquakes, tropical cyclones, and excessive rainfall, thereby mitigating the inherit short term cash flow problems experienced by small developing economies - particularly in stances following significant catastrophic events. It also aids its recipients by financing their initial disaster response as well as maintaining basic government functions.

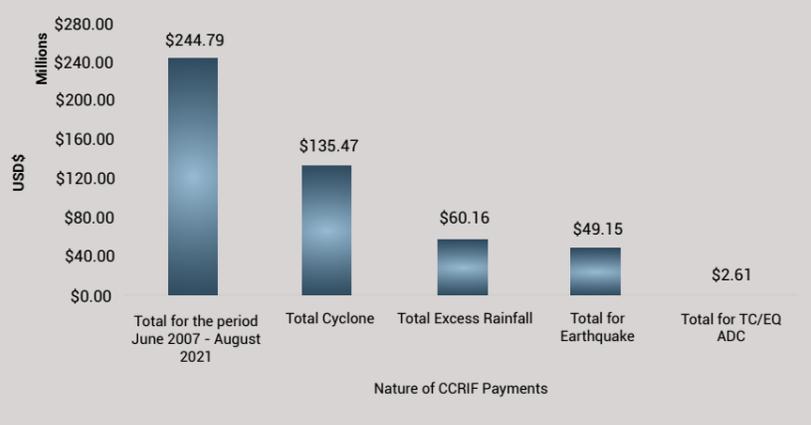
**CCRIF coverage:** This is divided into three policy types: (i) Earthquake Policies, (ii) Tropical Cyclone policies and (iii) Excessive Rainfall policies. Since October 2010, the island of Barbados has received seven (7) substantive payments totalling USD\$ \$21,774,135.00 (BBD \$43,548,270.00) as seen in Figure B1.1 - representative of 8.9% all CCRIF pay-outs since the inception of the multi-country risk pool mechanism in 2007. Primarily, these payments to Barbados alleviated pressure on the public budget. In 2010, Barbados sought financial assistance from the CCRIF to deal with the devastation following the passage of Tropical Cyclone Tomás. This pay-out amounting to USD \$ \$8,560,247.00 (BBD \$17,120,494.00) is highly significant not only because it represents the biggest pay out to Barbados, but also because its sum was only surpassed by two territories in other instances - payments to Turks and Caicos following the passage of Tropical cyclone Irma in September 2017, and payments to Haiti in October 2016 following the passage of Tropical Cyclone Matthew. In 2018, Barbados was the first recipient of CCRIF financing having received another substantive CCRIF payment of USD \$5,813,299.00 (BBD \$11,626,598.00) following the passage of Tropical Storm Kirk. for non-catastrophic events. In 2018 and subsequently in 2021, Barbados was the first recipient of CCRIF financing having received another substantive CCRIF payment following the passage of Tropical Storm Kirk and Hurricane Elsa.

Citing concerns over Barbados' predominantly reactive stance to DRM, the CDEMA has urged the GoB to restore its catastrophe fund to its previous levels as the current state of affairs lends to the potential depletion of financial resources and its almost complete reliance on external sources of financing for non-catastrophic events.

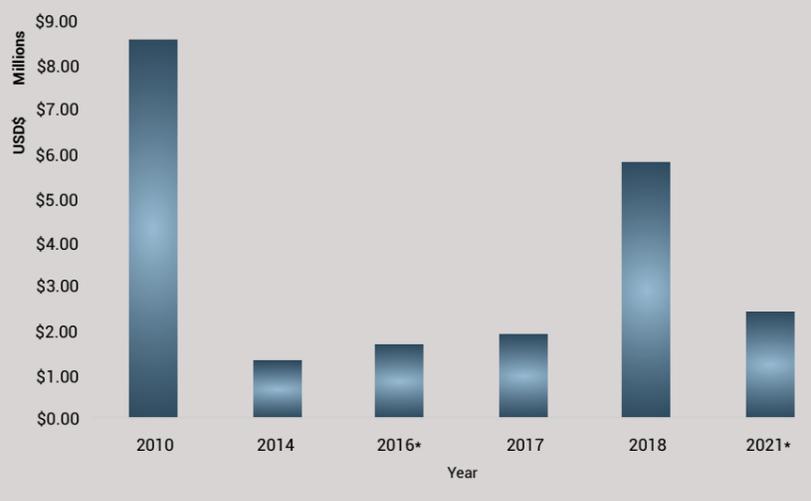
Source: CCRIF Regional Database

Relief in Barbados has been predominantly sought to deal with excessive flooding. Over the period 2016-2021, Barbados received payments amounting to USD\$9,608,506.00 (BBD\$19,217,012.00) - representative of 15.97% of all CCRIF excessive rainfall policies to date (USD \$60,161,835.00 or BBD \$120,323,670.00). These funds were used to provide disaster relief in the aftermath of the following hydrometeorological hazards (as seen in Figure B1.2): Tropical Cyclone: Matthew (USD \$1,728,227.00 or BBD \$3,456,554.00); Tropical Cyclone: Maria (USD \$1,917,506.00 or BBD \$3,835,012.00); and Tropical Storm Kirk (USD \$5,813,299.00 or BBD \$11,626,598.00) and Hurricane Elsa USD\$1,124,424.00 or BBD \$2,248,848.00).

**Figure B1.1: The Sum of CCRIF Payments to all Recipient Countries (USD\$)**



**Figure B1.2: CCRIF Payments to Barbados (USD\$)**



Source: CCRIF Regional Database

\*The year 2016 is noted by two payments: (i) Tropical Cyclone policy amounting to USD\$0.975 million and (ii) an Excessive Rainfall policy amounting to USD\$753,277.00. \*The year 2021 is noted by two payments: (i) Tropical Cyclone policy amounting to USD \$1,345,500.00 and (ii) an Excessive Rainfall policy amounting to USD \$1,124,424.00

## Box 2 - Disaster Impacts in Barbados: The Aftermath of Hurricane Janet

### Event Summary

On September 21st, 1955, a tropical storm originating 600km to the east of Barbados formed across the Atlantic Ocean for what some deemed a usual occurrence within the Atlantic Hurricane season. With limited warning and preparation as well as a general lack of understanding of hydrometeorological hazards - particularly as it relates to 'protocols during the calm of the storm', the tropical storm transitioned to a Category 3 Hurricane, severely impacting the southern part of the Barbados (mainly Silver Sands, Christ Church and others portions of St. Philip) at a sustained speed of 120 miles per hour. Similar, yet less catastrophic effects were felt in the northern portion of the island, where 60 miles per hour gusts were reported.



Figure B2.A: Track map of Hurricane Janet, 1955

This hurricane left a large path of devastation on the island to the extent that it was declared as a National Emergency. Upon leaving Barbados, the hurricane (now Category 4) remained on the usual westward track across the Caribbean Region where it posed devastating impacts to the economies of St. Lucia, St. Vincent and the Grenadines, Grenada and whilst over the Caribbean Sea, the hurricane continued to fluctuate between Category 4 and Category 5 on its approach to the Yucatan peninsula. The hydrometeorological system made landfall in Veracruz, Mexico as a Category 5 system on September 30th, 1955, and later dissipated as it moved further inland. Hurricane Janet was deemed as the most powerful Hurricane in the 1955 Atlantic Hurricane season.

### Resource Challenges on the Island

During this stage of economic development, the island of Barbados was still deemed as a colony of the British Empire partaking in primary activities such as fisheries, crop (mainly sugar cane) and cotton production. The construction of the traditional, wooden houses and chattel houses for the lower class therefore dominates this period; however, some instances of wall constructs for the upper middle class were also observed. Nearly all homes within the lower income bracket lacked basic electricity, running water or sanitation facilities. Traditionally many Barbadians have lived in villages and 'tenancies'. A tenancy arrangement under which a person may own their own home and rent the land on which it is located. Tenancies often comprise wooden houses placed on temporary foundations, locally known as chattel houses, and were located traditionally on the borders of the large estates.

Table B2.1	Existing Resource challenges in 1955
Institutional	<ul style="list-style-type: none"> <li>In 1955, there was no Department of Emergency Management, rather a Hurricane Relief organization whose mandate was distinct to solely deal with relief efforts and not efforts to reduce disaster risk prior to the occurrence of a hazardous event.</li> <li>Lack of an adequate warning mechanism. The sole entity on the island to disseminate information regarding a natural hazard was Barbados Rediffusion (radio company). This was a common occurrence prior to the 1960s.</li> <li>Extensive damage to infrastructure such as Emergency shelters, homes, and schools.</li> <li>Telecommunications across the island were also disrupted.</li> </ul>
Financial	<ul style="list-style-type: none"> <li>Financial resources were derived from the British Empire.</li> </ul>
Technical	<ul style="list-style-type: none"> <li>No satellite technology existed on the island to inform appropriate decision making in terms of preparation, response, and recovery.</li> <li>A general lack of understanding of hydrometeorological hazards - particularly as it relates to 'protocols during the calm of the storm' by the public.</li> </ul>
Human	<ul style="list-style-type: none"> <li>Limitations in the stock of nurses and carpenters to adequately deal with the devastation and reconstruction efforts during the aftermath of Hurricane Janet.</li> </ul>

Source: The Barbados Government Information Service

## Box 2 - Disaster Impacts in Barbados: The Aftermath of Hurricane Janet (Cont'd)

### Direct impacts

Hurricane Janet was the first hydrometeorological system to directly impact Barbados in a sixty (60) year time span. Noting such, no degree of experience could adequately prepare the citizens for its aftermath. The system, which was associated with extensive wind speeds rather than mere rainfall, resulted in the destruction of 8,000 chattel homes (wooden constructs), 25,000 cases of extensive property damage and approximately 20,000 homeless. In addition to this, extensive infrastructural damage to social institutions like churches and schools which are primarily deemed as emergency shelters for varied strengths of hydrometeorological systems was also noted.

### Indirect impacts

Indirect impacts posed by the aftermath of Hurricane Janet include public health challenges posed by the rising incidence of casualties and fatalities; poor sanitation practices caused by a lack of running water and or basic bathroom facilities resulting in typhoid fever, gastroenteritis, and dysentery; and other related illnesses such as pneumonia and chronic asthma - the latter of which is associated with high levels of dust in the atmosphere originating from debris. The GoB provided rations via the institution of a voucher to maintain adequate food supplies and to ensure that households get an appropriate ration share.



Figures B2: The extent of infrastructural damage posed by Hurricane Janet

### Secondary effects

Secondary effects associated with the crisis include the derailment of livelihoods associated with coastal activities - particularly in the fishing industry resulting in revenue losses and infrastructural damage; limitations in the stock of nurses and carpenters to adequately deal with the devastation and reconstruction efforts during the aftermath of Janet. For refuge, some citizens resorted to living in schools whilst their housing stock was being rebuilt and or repaired. In some instances, some citizens remained in schools for a two-week duration which severely hampered to the educational schedule on the island as some schools were therefore deemed as 'out of commission'. Migration schemes to the United Kingdom was a common exercise to repatriate money home in attempts to support the extended family.

### Lessons for the future:

- Improvements in capacity building at the national and community levels
- Improvements in institutional, technical, human, and financial capacities to deal with prevalence of hazardous events
- Diversification of livelihood strategies
- Advancement in housing design - particularly with the chattel house stock

Source: The Barbados Government Information Service

### Box 3 - Benefits of Disaster Risk Management Expenditures

#### Tropical Storm Tomás Impacts and Lessons Learned

In October 2010, this system developed very quickly into a tropical storm. Emergency plans were thus initiated by Department of Emergency Management (DEM) late on the night of October 30th. Shelters were not opened but individuals were advised to consider if it was in their best interest to stay home or relocate to the home of a friend or relative. Damages and cracks were experienced on roadways across the island and fallen trees blocked roadways. Impacts from this powerful tropical storm led to damage to many roofs, knocked down power lines, uprooted trees and caused much of the island's residents to lose power for more than 24 hours. As an estimate of the damage caused by the tropical storm, the island received a pay-out of US\$8.6 million from Caribbean Catastrophe Risk Insurance Facility (CCRIF). The vulnerability of public utilities was exemplified in the fact that the Barbados Light and Power Company struggled for more than 7 days to return service to some central areas after 75-80% of the electricity service was damaged. The irregularity/infrequency of tropical cyclones/storms when compared to neighbouring/other Caribbean countries, has led to an attitude of complacency in the general population (CDEMA, 2010). This event demonstrated that most individuals are not actively or regularly taking steps to reduce their own vulnerability through investment in shutters, maintenance of secure roofs or vigilance of storm systems throughout the entire hurricane season.



Figure B3-A: Damage due to Tropical Storm Tomás: A Sunken Catamaran in the Careenage

#### Flooding in St Peter and St Lucy

On April 11, 2011, a low-pressure system passed over the southern islands of the Lesser Antilles bringing unseasonal precipitation. Overnight heavy rainfall caused flooding in many communities across St. Peter and St. Lucy parishes. Persons in the communities of Rose Hill, Collerton, and Gills Terrace were inundated with mud and water that moved large appliances and damaged furnishings and vehicles. The DEM and the local District Emergency Organisation (DEO) worked together to assist the affected households and the Barbados Defence Force was requested to provide further support (CDEMA, 2011).

Source: Department of Emergency Management, 2014

## 1.3 Socio-Demographic Characteristics

This section provides an examination of the socio-demographic aspect of the country. It has been subdivided into a macroeconomic profile, demographic characteristics and a national overview of health; poverty; education; energy, water, food and citizen securities; solid waste and sewage infrastructure; transportation; telecommunications and housing dynamics.

### 1.3.1 Macroeconomic Background

Since achieving independence in 1966, Barbados has been viewed as a model for all Small Island Developing States (SIDS), despite the fact that it is crippled by limited natural resources and high vulnerability to environmental, social and economic threats. The economy is based upon a social market model that is characterized by extensive social welfare provisions – especially in the areas of health and education. This steadfast commitment to democracy, enterprise and gradual liberalization is exemplified in enviable economic and quality of life statistics.

The Barbadian economy is the largest in the Eastern Caribbean<sup>8</sup> and, pre-pandemic, was estimated to have shrunk by 0.1% in 2019. This contraction represented an overall GDP that is approximately 5% below its 2008 peak. Before the onset of the COVID-19 Pandemic, the Central Bank of Barbados predicted that the country's economy would grow between 1.25% and 1.75%. In June 2018, as a response to its worsening fiscal and external liquidity position, the Government of Barbados (GoB) announced its homegrown Barbados Economic Recovery and Transformation (BERT) Plan aimed at restoring macroeconomic stability whilst safeguarding the financial and social sectors. The BERT Plan included the suspension of payments due on debt owed to external commercial creditors as well as a comprehensive restructuring of domestic and external debt. To facilitate this, the GoB has been engaged in an International Monetary Fund (IMF) programme under the Extended Fund Facility since 2018<sup>9</sup>. The programme's main target is to achieve a 60% debt to GDP ratio by 2033.

Additionally, a primary surplus of 6% of GDP each year is required to reach that target. Within the fiscal year of 2019/2020, Barbados achieved the primary surplus target of 6.1% of GDP.

In 2021, GDP per capita for the island ranked 11th amongst comparators (USD \$13,487.10) sitting in the lowest quartile amongst the 22 comparator countries. Barbados also ranked 8th relative to other Commonwealth Small States in the Caribbean Region (as seen in Figure 3). In 2020, the domestic economy of Barbados exhibited some degree of diversification (as seen in Figure 4). This was predominantly driven by five sectors: tourism (45.8%); wholesale, retail, restaurants, and hotels (25.4%); transport, storage, and communications sectors (12.9%); manufacturing and utilities (8.5%); and to a lesser extent - agriculture (1.5%); construction (5.7%); and manufacturing (5.6%). This time series was marked by slight periods of economic contraction between 2002-2004, 2006-2008 and 2012-2014, which followed on from an extensive period of steady growth from 1998-2003. After this, the economy rebounded - growing modestly from 2014 onwards.

Barbados relies heavily on tourism for foreign exchange earnings. The accommodation and food services sector accounts for approximately 17% of economic activity and 13% of total employment (United Nations National Accounts Database, 2021). Notably, women constitute around 62% of employment in the accommodation and food services industry. Barbados' unemployment rate is estimated to be around 10% - the female unemployment rate is 8.5%, while the male unemployment rate is 11.6%. The within-year volatility of employment is significant with an average seasonal dip in employment of approximately 7,000 workers each year. This is likely due in large part to the highly seasonal nature of tourism activity in Barbados<sup>10</sup>.

<sup>10</sup> The UNDP, UNICEF and UN Women Eastern Caribbean COVID-19 Heat Series: Barbados COVID-19 HEAT Report - Human and Economic Assessment of Impact, 2020

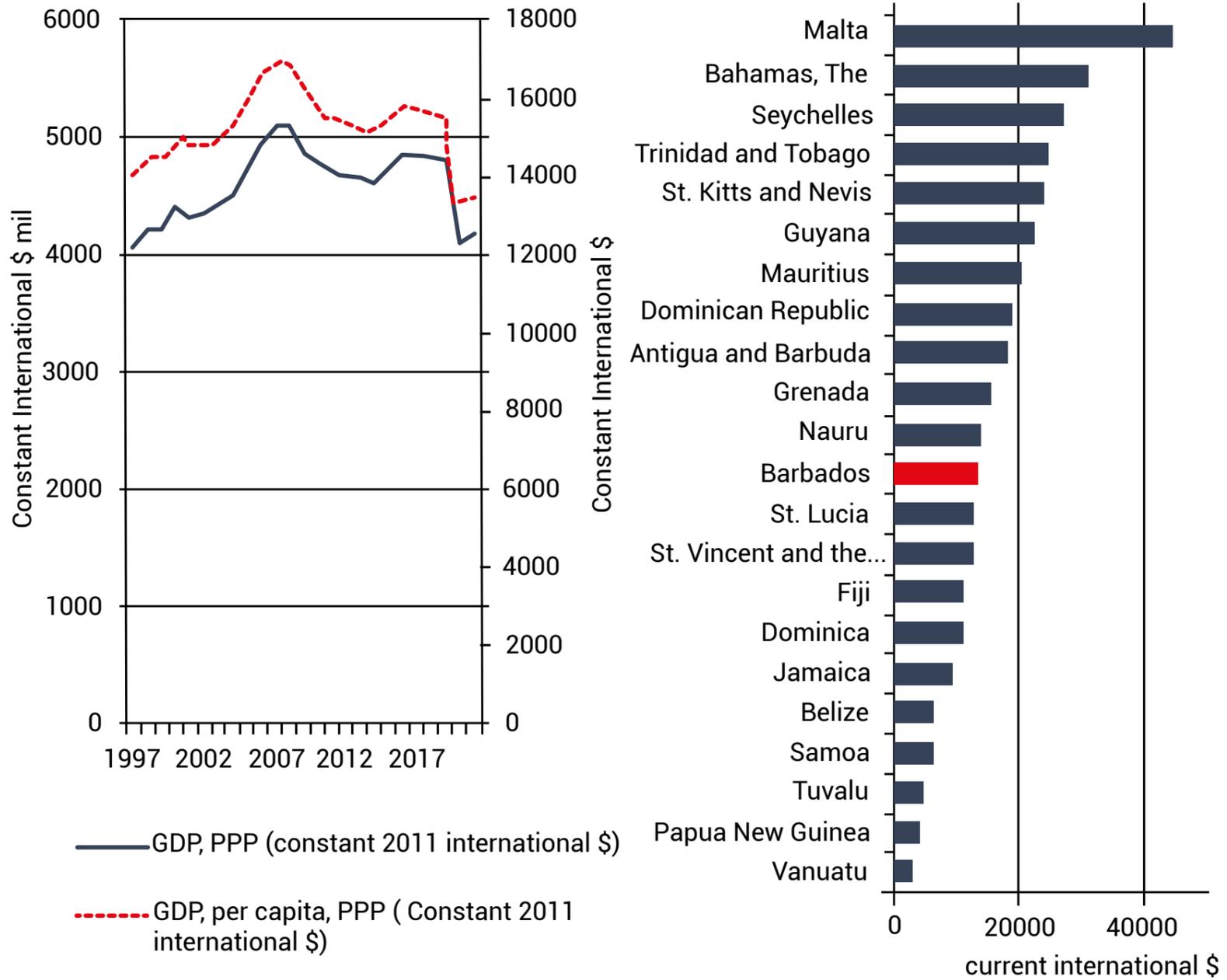
<sup>8</sup> The UNDP, UNICEF and UN Women Eastern Caribbean COVID-19 Heat Series: Barbados COVID-19 HEAT Report - Human and Economic Assessment of Impact, 2020

<sup>9</sup> In late September 2022, Barbados was granted an Extended Fund Facility via a newly established Resilience and Sustainability Trust (RST) to help build resilience against climate change; to reduce public debt while facilitating capital expenditure to boost growth and to transition the economy to a 100% green economy by 2030.

**Figure 3: GDP Dynamics for Barbados and other Comparators (1997-2021)**

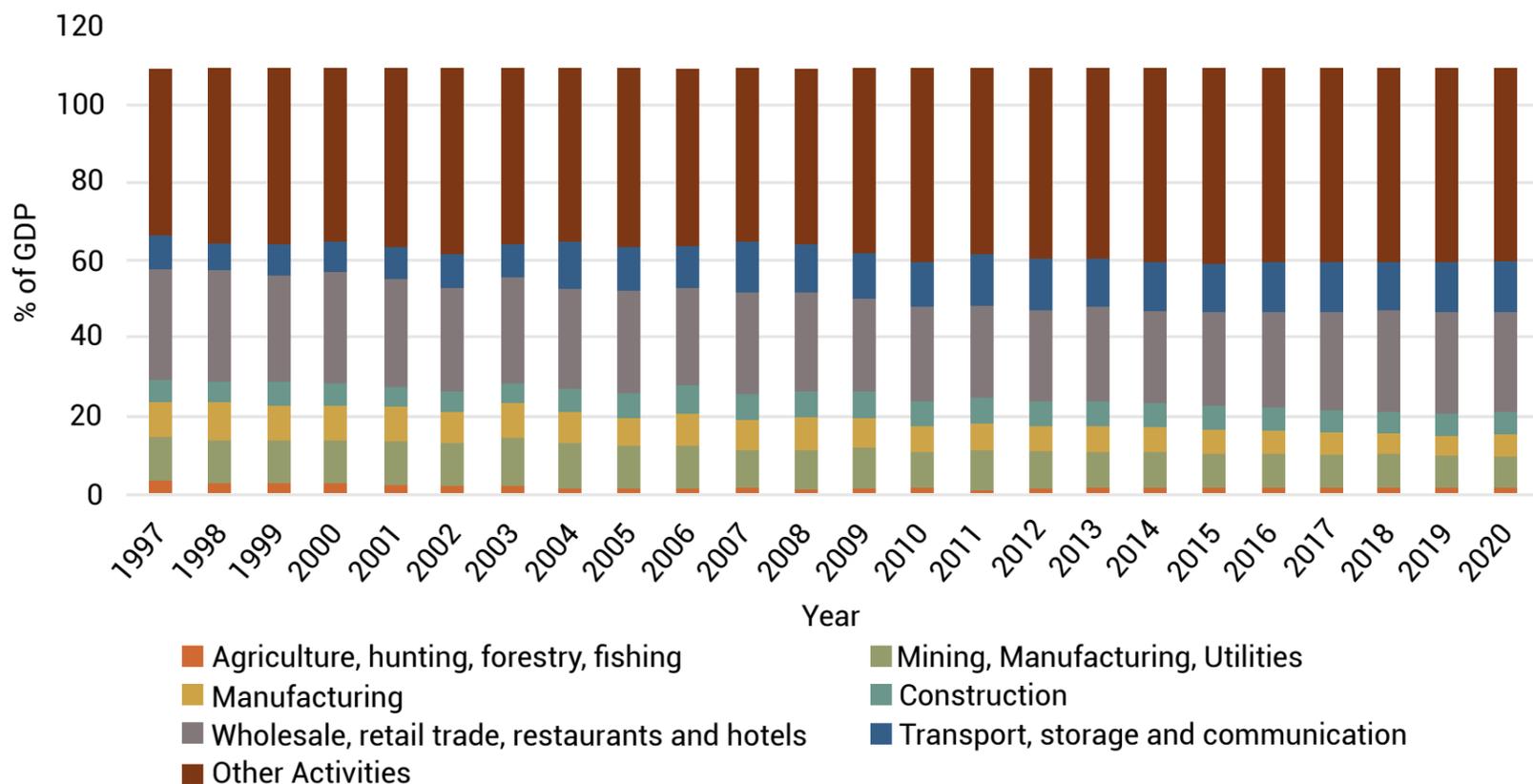
GDP Dynamics 1997-2021

GDP Per Capita 2011, PPP (current international \$)



Source: World Development Indicators

**Figure 4: GDP Decomposition by Industry for Barbados (1997-2021)**



Source: United Nations National Accounts Database

### 1.3.2 Governance Structure

Barbados became an independent parliamentary democracy after declaring its independence from the United Kingdom of Great Britain on the 30th of November 1966. Since then, it was closely linked to the United Kingdom in political and legal matters where the British Monarch was deemed as Head of State and represented locally by the Governor General. Barbados' Prime Minister and Government exercise executive power. The Senate has 21 members, all appointed by the Governor-General; and the House of Assembly has 30 elected members, reflecting the thirty (30) constituencies of the island. Sustainable Development Goal 5 (SDG 5) seeks to promote gender equality and its SDG Target 5.5 seeks to ensure women's full and effective participation and equal opportunities for leadership at all levels of decision-making in political, economic, and public life. In 2021, 29.4% of the parliamentary seats were held by women (UNDP, 2022). Since November 30th, 2021, the island attained republican status and appointed the Governor-General Dame Sandra Mason as the President of Barbados and retained the Right Honourable Mia Amor Mottley as the island's Prime Minister.

The Constitution of Barbados is the supreme law of the nation, and the Chief Justice heads the independent judiciary. Barbadian law was initially based entirely on English common law and there have been a few local adaptations and, along with the Barbados Constitution, these form the basis of the country's legal system. More recently, international organisations have influenced the legislation, including the United Nations (UN), the Organization of American States, and other international bodies. Barbados is a full and participating member of the Caribbean Community (CARICOM). As a consequence of the established governance structure, the realized post-independence social and economic stability and level of development; Barbados is considered to have low political risk<sup>11</sup> and has attained one of the highest living standards in the developing world.

<sup>11</sup> The Political Stability and Absence of Violence/Terrorism index under the 2021 World Governance Indicators (WGI) ranks Barbados as 19th in the world with 91.98%. This index measures perceptions of the likelihood of political instability and/or politically-motivated violence, including terrorism. Percentile rank indicates the country's rank among all countries covered by the aggregate indicator, with 0 corresponding to lowest rank, and 100 to highest rank. Percentile ranks have been adjusted to correct for changes over time in the composition of the countries covered by the WGI.

### 1.3.3 Demographic Characteristics

Across the Caribbean Basin, the level of Human Development (as calculated by the UNDP) has not undergone any significant change between 2015 and 2021<sup>12</sup>. Most countries have either maintained their scores or experienced marginal improvements. Out of the selected CARICOM Member States, Trinidad and Tobago was the only that was characterized as having 'very high' development in 2021 - well above the Latin American and Caribbean average of 0.754 as well as the Small Island Developing States average of 0.730 (UNDP, 2022). Trinidad and Tobago ranked 57th with a HDI score of 0.810. Grenada followed closely on this measure - ranking 68th whilst attaining the highest HDI rank across Barbados and the Organization of Eastern Caribbean States. In contrast, Barbados ranked 70th with a HDI index score of 0.790. This coincided with a GNI per capita of \$12,306, expected years of schooling of 15.7 years and an overall life expectancy of 77.6 years. The HDI ranks for the remaining CARICOM Member States are as follows: Antigua and Barbuda (71); Saint Kitts and Nevis (75); Saint Vincent and the Grenadines (89); the Commonwealth of Dominica (102); Saint Lucia (106); and Jamaica (110), respectively. Trends in Human Development for selected CARICOM Member States can be seen in Table 2.

<sup>12</sup> UNDP. 2022. "Human Development Report 2021-2022: *Uncertain Times, Unsettled Lives: Shaping our Future in a Transforming World*". <https://hdr.undp.org/content/human-development-report-2021-22>

**Table 2: ECA Human Development Index Classifications and rankings by country/territory, 2021**

Country	Human Development Index			Life Expectancy at birth (SDG 3)	Expected Years of schooling (SDG 4.3)	Mean years of schooling (SDG 4.6)	Gross National Income per capita (2017 PPP\$ (SDG 8.5))
	Rank	Classification	Value				
Antigua and Barbuda	71	High	0.788	78.5	14.2	9.3	16,792
Barbados	70	High	0.790	77.6	15.7	9.9	12,306
Dominica	102	High	0.720	72.8	13.3	8.1	11,488
Grenada	68	High	0.795	74.9	18.7	9	13,484
Jamaica	110	High	0.709	70.5	13.4	9.2	8,834
Saint Kitts and Nevis	75	High	0.777	71.7	15.4	8.7	23,358
Saint Lucia	106	High	0.715	71.1	12.9	8.5	12,048
Saint Vincent and the Grenadines	89	High	0.751	69.6	14.7	10.8	11,961
Trinidad and Tobago	57	Very High	0.810	73	14.5	11.6	23,392
LAC Average	...	...	0.754	72.1	14.8	9.0	14,521

Source: UNDP, 2022

Barbados is the one of the most densely populated countries in the Western Hemisphere. Despite this, the island has controlled its rate of population growth through the successful implementation of an island-wide family planning programme over the past five decades. By the end of 2021<sup>13</sup>, the resident population was estimated at 287, 708<sup>14</sup> and the rate of population growth in 2021 was 0.11%. This measure has been on the steady decline since 2009 when a population growth rate of 0.41% was attained. 51.6% of the Barbadian population is comprised of females whereas males account for 48.4%. In 2021, the Gender Development Index for Barbados stood at 1.034<sup>15</sup> attaining the 2nd highest rank within the UNDP's Country Group Classifications<sup>16</sup> for this index. This score was well above the Latin American and Caribbean average of 0.986 and the Small Island Developing States average of 0.962. Similarly, the Gender Inequality Index for Barbados stood at 0.268<sup>17</sup> attaining a rank of 64 well below the Latin American and Caribbean average of 0.381 and the Small Island Developing States average of 0.461. Population dynamics disaggregated by gender can be seen in Figure 5.

13 The World Development Indicators

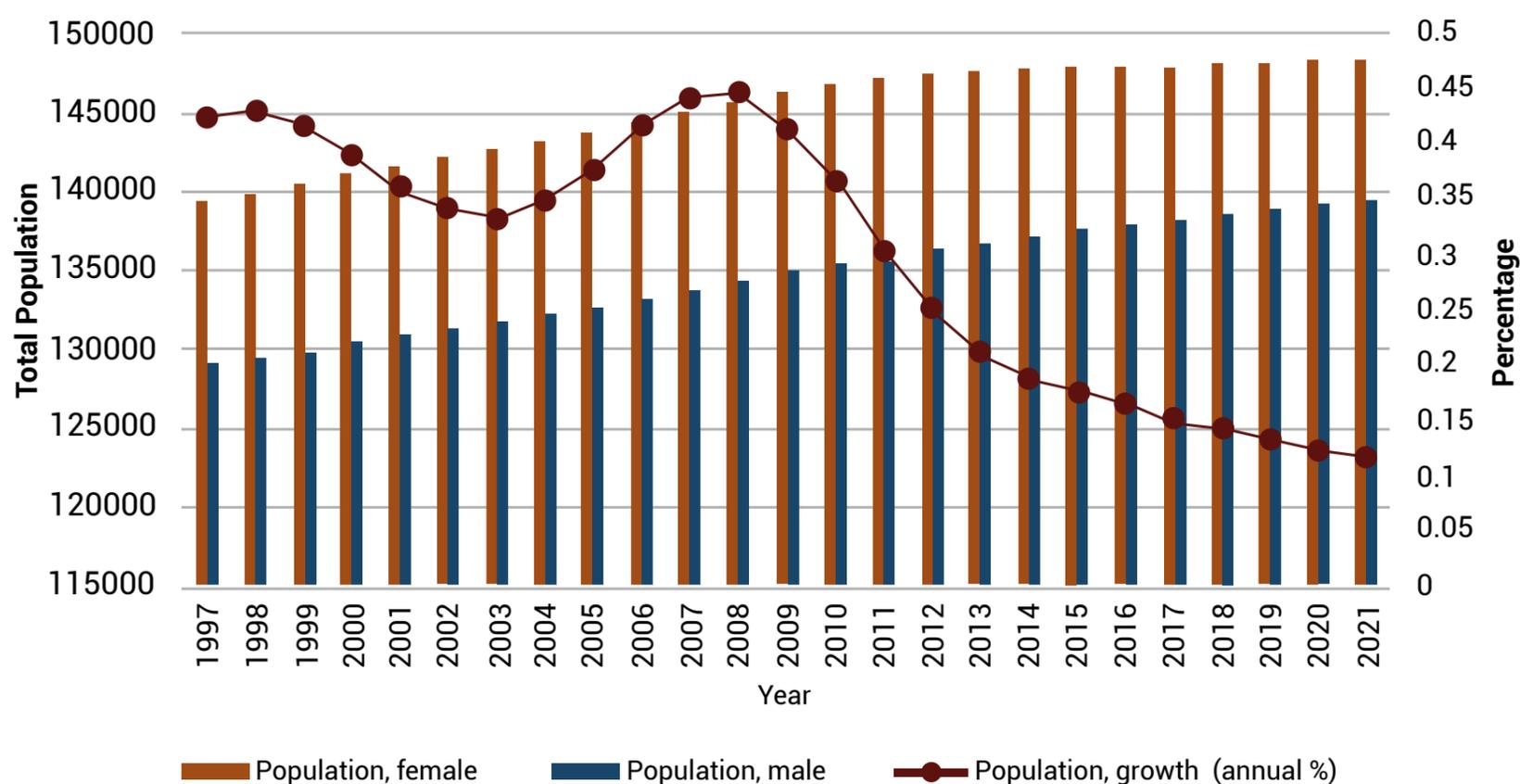
14 As a result, of the COVID-19 pandemic, the 2020 Barbados Census was delayed. However, there was a large influx of tourists as a result of the newly established 'Barbados Welcome Initiative'.

15 In the Gender Development Index, Barbados was classified as a Group 2 country: Medium to high equality in HDI achievements between women and men (absolute deviation of 2.5–5 percent)

16 For Gender Development Index groups, countries are divided into five groups by absolute deviation from gender parity in HDI values. Group 1 comprises countries with high equality in HDI achievements between women and men (absolute deviation of less than 2.5 percent). Group 2 comprises countries with medium to high equality in HDI achievements between women and men (absolute deviation of 2.5–5 percent). Group 3 comprises countries with medium equality in HDI achievements between women and men (absolute deviation of 5–7.5 percent). Group 4 comprises countries with medium to low equality in HDI achievements between women and men (absolute deviation of 7.5–10 percent) and Group 5 comprises countries with low equality in HDI achievements between women and men (absolute deviation from gender parity of more than 10 percent).

17 Gender Inequality Index: A composite measure reflecting inequality in achievement between women and men in three dimensions: reproductive health, empowerment and the labour market. See Technical note 4 at [http://hdr.undp.org/sites/default/files/hdr2022\\_technical\\_notes.pdf](http://hdr.undp.org/sites/default/files/hdr2022_technical_notes.pdf) for details on how the Gender Inequality Index is calculated.

Figure 5: Population Dynamics disaggregated by Gender (1997-2021)



Source: World Development Indicators

Concurrently, the proportion of the population aged 65 years and over has risen. In Barbados, this trend has been quite significant over the years as the nation's boast of being one of the leading countries in the world with the highest number of centenarians per capita<sup>18</sup>. In 1999, persons 65 years and over accounted for approximately 11.3% per cent of the total population. By 2021, this ratio gradually increased and accounted for approximately 18% of the Barbadian population.

The average rate of life expectancy across the Caribbean region is relatively high, with most countries reporting that on average most residents live well beyond 60 years of age. In comparison to other territories across the English-Speaking Caribbean<sup>19</sup>, Barbados exhibited the highest life expectancy rates in 2021 for both females and males. While males in Barbados tend to have shorter lifespans than their female counterparts, they still had higher rates of life expectancy than males in other Caribbean countries<sup>20</sup>. In Barbados, the average life expectancy at birth for 2021 was 65.7 years (females: 80.5 years; males: 77.9 years) with 82.79% of mortality cases in recent times being attributed to non-communicable diseases. With an increasingly aging population, more funds and resources will therefore need to be allocated for healthcare

services and associated amenities. In Barbados, there is a large proportion of funds primarily placed to treat non-communicable diseases. This, coupled with the incidence of low fertility rates will result in a labour-force deficit in the coming years<sup>21</sup>. This will pose negative implications on productivity, labour costs and possible business expansions. It will also enhance the overall competitiveness of firms across intra-regional and extra-regional markets.

Sustainable Development Goal 3 (SDG 3) seeks to promote good health and well-being. In Barbados, the mortality rate for adult women (per 1,000 female adults) and adult men (per 1,000 male adults) in 2020 stood at 90.4 and 126.85, respectively<sup>22</sup>. The SDG Target 3.1 seeks to reduce the global maternal mortality ratio to less than 70 per 100,000 live births by 2030. For Barbados, the maternal mortality ratio (per every 100,00 births) stood at 27. The SDG Target 3.2 seeks to end preventable deaths of new-borns and children under 5 years of age, with all countries aiming to reduce neonatal mortality to at least as low as 12 per 1,000 live births and under-5 mortality to at least as low as 25 per 1,000 live births by 2030. For Barbados, the neonatal, infant and under-5 mortality rates (per 1,000 births) in 2020 stood at 8.1; 11.4; and 12.2, respectively. The SDG Target

18 UNDESA. 2015 "Population Division Report on World Population Ageing".

19 The World Bank. 2021 "Health, Nutrition and Population Statistics". Datasets ranged from 1997-2021.

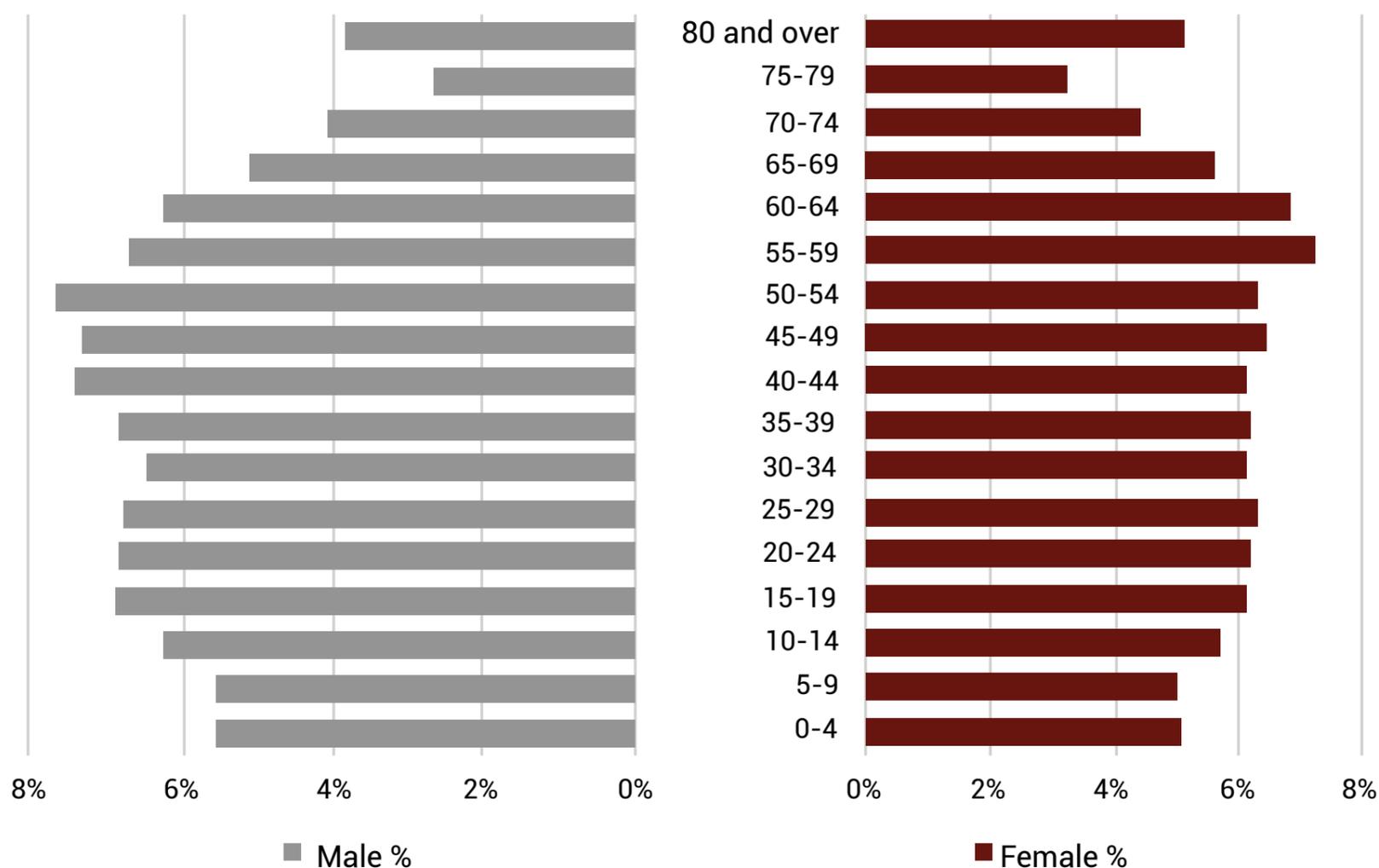
20 The World Bank. 2021 "Health, Nutrition and Population Statistics". Datasets ranged from 1997-2021.

21 To address this reality, the Government of Barbados embarked upon 'The Barbados Welcome Stamp Initiative' as the spread of the COVID-19 pandemic lessened to facilitate the extended stay of visitors and Barbadian expatriates who wish to conduct work-from-home modalities in this preferred Caribbean destination.

22 The World Bank. 2021 "Health, Nutrition and Population Statistics". Datasets ranged from 1997-2021.

3.7 seeks to ensure universal access to sexual and reproductive health care services, including for family planning, information and education, and the integration of reproductive health into national strategies and programs by 2030 (UNDP, 2022). For Barbados, the adolescent birth rate (births per 1,000 women ages 15–19) stood at 42.3. The overall fertility rate in Barbados stood at 1.628% in 2020. Jointly, these two indices – population dynamics and life expectancy will heighten the age dependency ratio in Barbados and place increasingly heavy burdens on the national budget. In 2021, the age dependency ratios stood at 25.9% for the elderly and 24.9% for the youth. The 2021 Age population distribution chart for Barbados is shown in Figure 6.

**Figure 6: Population Dynamics disaggregated by Age and Gender, 2021**



Source: World Development Indicators

Barbados is divided into eleven (11) parishes and has four main historical towns: Bridgetown, Speightstown, Holetown and Oistins. The country's capital and Central Commercial District is the the City of Bridgetown. According to results obtained from the 2010 Barbados Population Census<sup>23</sup>, approximately 73% of the country's population is settled along the south, south-east, southwest, and western coasts of the island<sup>24</sup> with 80% of its socioeconomic activities being situated within 2 kilometres of the coastline<sup>25</sup>. This therefore continues to exacerbate the risk posed from climate change impacts for both people and infrastructure - particularly as it relates to sea level rise, coastal flooding, saltwater intrusion and storm surges. However, there has been a steady rise in settlements within the central parish of Saint George from 1980 onwards. The 'suburbanization' phenomena emerging from the capital, Bridgetown is expected to continue, leading to the gradual increase in densities to the northwest, north and east of Bridgetown, while it is expected that most other areas will remain relatively constant. Figure 7 highlights the population statistics across parishes within Barbados in a given census year from 1980 onwards, whereas Figure 8 highlights the extent of urbanization. Figure 9 disaggregates the Barbadian population by ethnicity<sup>26</sup>.

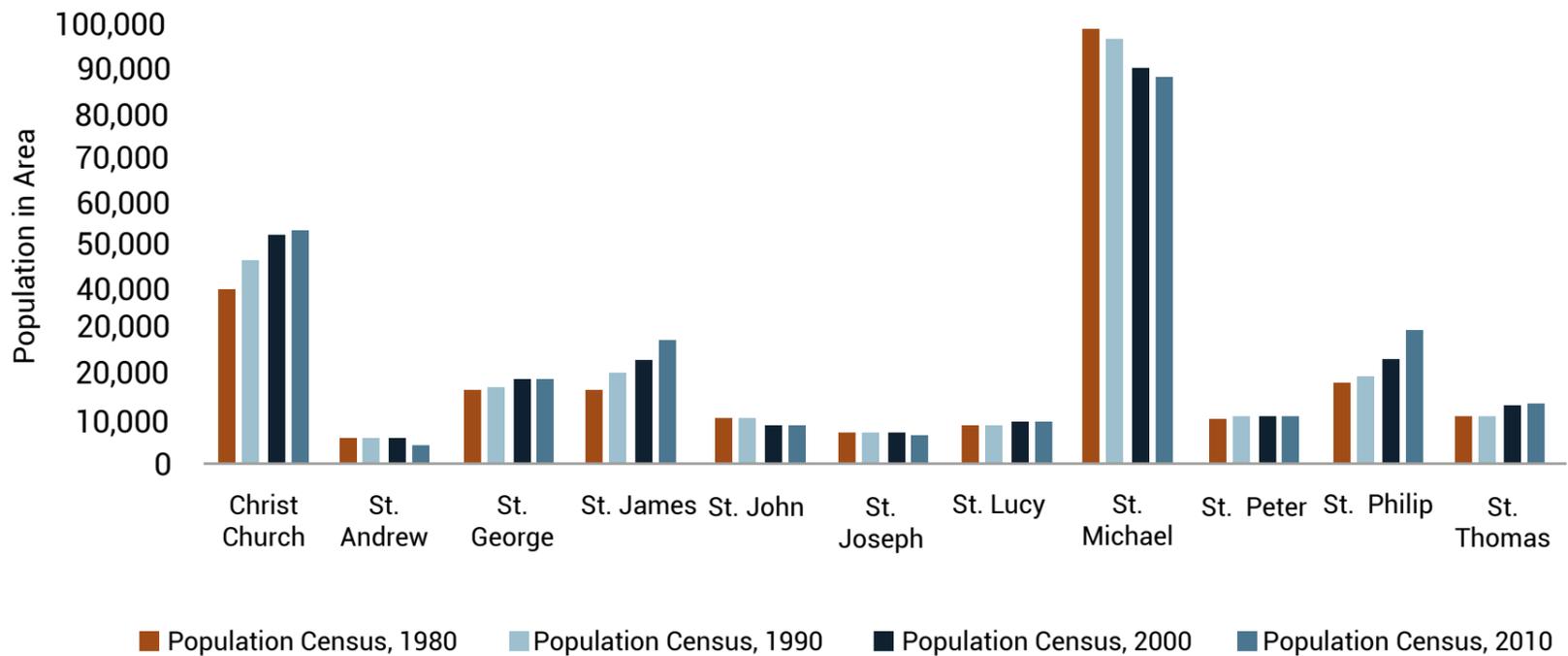
<sup>23</sup> The National Census for Barbados is conducted every ten years. The 2010 numbers consider an undercount of 18%. The 2020 Census for Barbados was delayed as a result of the onset of the COVID-19 Pandemic.

<sup>24</sup> Predominately, this correspondences to the coastal parishes of Christ Church, Saint Philip, Saint Michael, and Saint James

<sup>25</sup> Government of Barbados. 2015. "Barbados National Report for the Third United Nations Conference on Housing and Sustainable Urban Development: HABITAT III". <https://habitat3.org/wp-content/uploads/Habitat-III-Report-Barbados-final.pdf>

<sup>26</sup> According to 2010 census, ethnic groups constitute the following percentages of Barbadian population: 92.68%: Black; 3.49%: White; 2.67%: Mixed; 0.99%: East India 0.05%: Chinese; 0.03: Arab; and 0.09%: Other.

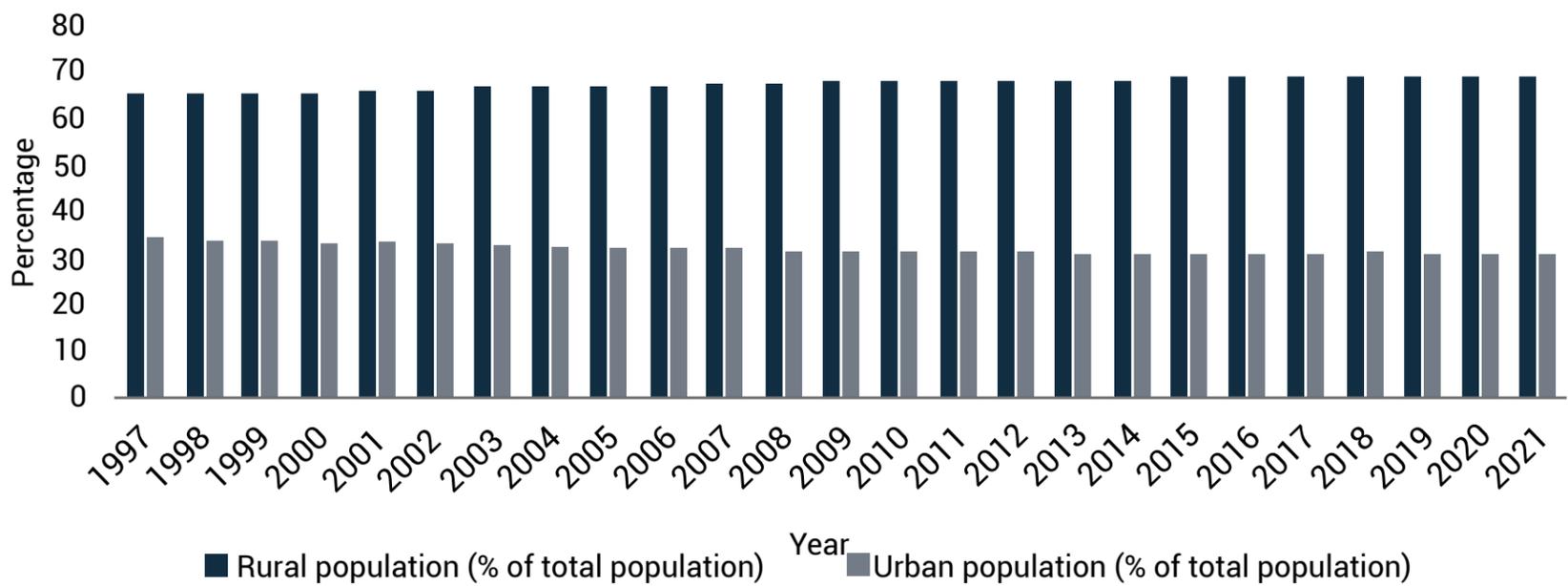
**Figure 7: Population Statistics by Parish (Census Years)**



Source: The Barbados Statistical Service

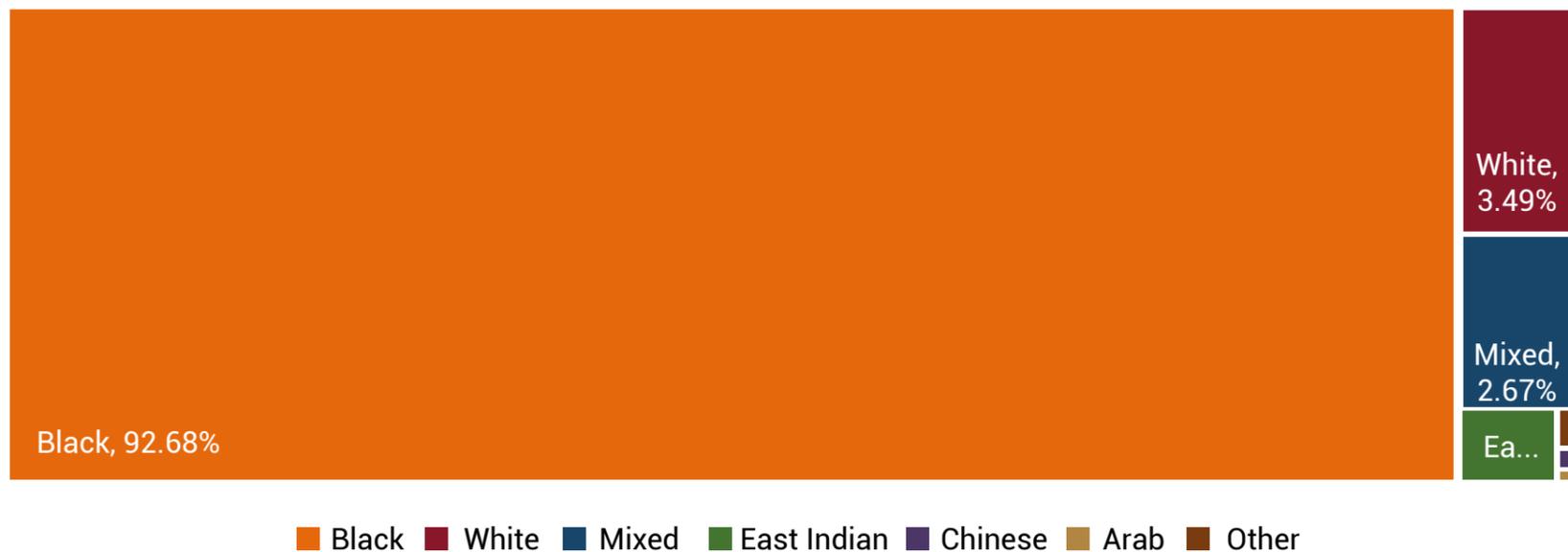
Note: Primary data for respective years was derived from the following sources. Population Census year (1980): The Britannica Book of the Year 1990; Population Census year (1990): The Government of Barbados: State of the Environment Report 2000; Population Census year (2000): CARICOM: National Census Report – Barbados; and Population Census year (2020): The Barbados Statistical Service: 2010 Population and Housing Census, Volume 1, 2013.

**Figure 8: Percentage of the Population Living in Rural and Urban Corridors (1997-2021)**



Source: World Development Indicators

**Figure 9: Ethnic Groups in Barbados**



Source: The Barbados Statistical Service

### 1.3.4 Health

Sustainable Development Goal 3 (SDG 3) seeks to promote good health and well-being; however, climate change represents the biggest global threat to human health in the 21st century. It is expected to affect population health via a host of factors with complex interrelationships, including exposure, socio-economic status, the built environment, and cultural practices. Even though the extent of the 'complexity between these interrelationships is not entirely understood, preliminary evidence based on current knowledge and future projections suggest that natural climate variability and anthropogenic drivers pose many direct and indirect challenges to human health' (IPCC, 2014). Under the assumption of continued progress in economic growth and health protection whilst considering few of the associated health risks, the World Health Organization suggests 'that climate change will cause approximately 250,000 additional deaths between 2030 and 2050' (WHO, 2014). Such health risks (as seen in Table 3) can arise from direct and indirect exposures as well as secondary impacts caused by economic and social disruptions.

**Table 3: Sources of Climate Change Risks**

<b>Direct exposures:</b>	Climate change-related alterations in the frequency, intensity, and duration of extreme weather events (e.g., heatwaves, floods, droughts, and windstorms). Each year, these events affect millions of people, damage critical public health infrastructure, and cause economic losses costing billions of dollars. The frequency and intensity of some types of extreme weather events are expected to continue to increase over coming decades because of climate change (IPCC, 2012), suggesting that the associated health impacts could increase without additional interventions, including impacts on mental wellness.
<b>Indirect exposures:</b>	The effects of climate change on natural and physical systems that, in turn, alter the number of people at risk of undernutrition, the geographic range and incidence of vector-borne, zoonotic, and food- and waterborne diseases, and the prevalence of diseases associated with air pollutants and aeroallergens. Climate change is projected to significantly increase the number of people at risk of these major causes of ill health. Furthermore, sea level rise associated with climate change can result in larger and more destructive storm surges, as well as food and water insecurity challenges associated with saltwater intrusion into freshwater drinking sources.
<b>Via economic and social disruption:</b>	Climate change can affect population health through climate-induced economic dislocation and environmental decline, as well as via development setbacks incurred by damage to critical public health infrastructure and livelihoods by extreme events.

Source: Smith et al., 2014; WHO, 2014

From a regional perspective, the average annual temperatures within the Caribbean Archipelago have increased by more than 0.5°C - approaching 1°C over the last 100 years. The health impacts of climate change can be classified into two categories: (i) simple extremes of climatic statistical ranges that can be attributed to natural climate variability and (ii) complex extremes that can be attributed to droughts, floods or hydrometeorological events. In addition to this, a regional 2018 study conducted by the Pan-American Health Organization identified clear priorities topics of action for the ministries of health across various Caribbean Governments. These include:

- Vector-Borne Diseases
- Weather and Emergencies
- Food Security/Safety
- Water-Borne Diseases
- Mitigation (Coordination with other sectors)
- Non-communicable diseases
- Air Pollution
- Allergies
- Heat-Related Illness
- Mitigation (Emissions form Health Facilities)
- Mitigation (Sustainable Procurement)

Barbados provides universal health care for all residents via eight (8) public polyclinics and one (1) public hospital. The Queen Elizabeth Hospital has 519 beds. There is also one (1) private hospital and three (3) main private medical clinics. To sensitize the public and to promote good environmental health and sanitation, the GoB (under the auspices of the Ministry of Health and Wellness) has highlighted the incidence of such threats via press releases and health promotional messages and campaigns. In addition to this, the Ministry has implemented environmental health policies within programs in six polyclinics geared towards overall health and good sanitary practices. Even though the development of such programmes that seeks to reduce the incidences of these vector-borne diseases is on-going; the overall success of the initiatives will largely depend upon public education and cooperation. In light of the COVID-19 pandemic, a number of these health care systems will need to be repurposed to promote transformational thinking.

### 1.3.5 Poverty

Sustainable Development Goal 1 (SDG 1) seeks to end poverty in all its forms everywhere; however, the rate of poverty in most Caribbean countries is still relatively high. Under Sustainable Development Goal 1 (SDG 1), Target 1.3 the Multidimensional Poverty Index provides a gauge on the extent of deprivation within a given county context across three (3) dimensions and ten (10) indicators: health (child mortality, nutrition), education (years of schooling, enrolment), and living standards (water, sanitation, electricity, cooking fuel, floor, assets), (UNDP, 2022). According to the 2021-2022 Human Development Report, an estimate for the Multidimensional Poverty Index (MPI)<sup>27</sup> for Barbados was derived from National surveys conducted over the period 2009-2020. In 2012, Barbados attained a MPI score of 0.009 - well above the Latin American and Caribbean average of 0.030. The extent of the population exhibiting multidimensional poverty by headcount was 2.5<sup>28</sup> which corresponded to 7000 persons. In terms of the Intensity of Deprivation within multidimensional poverty<sup>29</sup>, this estimate

27 The Multidimensional Poverty Index represents the proportion of the population that is multidimensionally poor adjusted by the intensity of the deprivations. See Technical note at <https://hdr.undp.org/system/files/documents//mpi2021technicalnotespdf.pdf> for details on how the Multidimensional Poverty Index is calculated.

28 The Multidimensional poverty headcount: indicates the extent of the population with a deprivation score of at least 33 percent. It is expressed as a share of the population in the survey year, the number of multidimensionally poor people in the survey year and the projected number of multidimensionally poor people in 2019.

29 The Intensity of Deprivation within multidimensional poverty is calculated as the average deprivation score experienced by people in multidimensional poverty.

accounted for 34.2% of the population. There were no estimates for the following components under the category of 'population in multidimensional poverty': (i) Inequality amongst poor; and (ii) the population in severe multidimensional poverty. Overall, The percentage of the Barbadian population that is vulnerable to multidimensional poverty is 0.5%<sup>30</sup> - that is 14,385 persons.

Data derived from the 2016 Caribbean Development's Bank Report<sup>31</sup> further emphasizes that 'based on country-specific poverty lines and consumption expenditures data, poverty, vulnerability and inequality levels are high' (CDB, 2016). According to the ILO<sup>32</sup>, the Poverty Gap Index 'measures the extent to which individuals fall below the poverty line (the poverty gaps) as a proportion of the poverty line' (ILO, 2005). As seen in Table 4, poverty levels within CARICOM Member States and Associate members varies drastically. With the following economies attaining very high poverty levels: Guyana (16.2); Belize (11.4) and high poverty levels in Grenada (10.13); Haiti; Saint Lucia (9); and St. Vincent and the Grenadines (7.5), respectively. In 2010, the Poverty Index Gap for Barbados was 6 – representative of a low poverty level. The island's Gini Coefficient of 0.47 indicates that they are low levels of inequality.

30 The World Bank. 2022. "The World Development Indicators". Datasets ranged from 1997 to 2021. At the end of 2021, the total population for Barbados was 287, 708 persons.

31 Caribbean Development Bank. 2016. "The Changing Nature of Poverty and Inequality in the Caribbean: New Issues, New Solutions."

32 International Labour Organisation. 2005. "The ILO Poverty Manual".

**Table 4: A Regional Assessment of Poverty**

Country	Year	Population Poor (%)	Population Vulnerable (%)	Population Indigent (%)	Poverty Gap Index	Gini Coefficient
Anguilla	2009	5.8	17.1	0	1.1	0.39
Antigua and Barbuda	2007	18.3	10	3.7	6.63	0.48
Barbados	2010	19	10.4	9.1	6	0.47
Belize	2009	41.3	13.8	15.8	11.4	0.362
BVI	2022	22	-	< 1	4.3	0.23
Cayman Islands	2006/7	2	1.8	0	0.44	0.3995
Dominica	2009	28.8	11.5	3	8.9	0.44
Grenada	2008	37.7	14.6	2.4	10.13	0.377
Guyana	2006	36.1	-	18.6	16.2	0.35
Haiti	2012	58.5	11.5	23.8	-	0.61
Jamaica	2012	20	-	-	4.5	0.3813
Saint Kitts	2008/9	23.7	-	1.4	6.4	0.382
Nevis	2008/9	15.9	-	0	2.7	0.38
Saint Lucia	2005	28.8	40.3	2	9	0.42
Suriname	2012	47.23				
Saint Vincent and the Grenadines	2007/8	30.2	48.2	2.9	7.5	0.4
Trinidad and Tobago	2005	15.5	9	1.2	4.6	0.39
Turks and Caicos	2012	21.6	11.4	0	4	0.36

Source: CDB, 2016; Several Regional Government's Reports and Documents; CDB (2002: 50); and World Bank (2011)

According to the 2016 Barbados Survey of Living Conditions, the percentage of the overall population characterized as poor was 17%, a 2% decrease from its 2010 estimate. Approximately 11% of the population was vulnerable whereas 9.1% of the population is characterized as indigent. Poverty rates amongst children (ages 0-17), adolescents (10-19), and adults stood at 35.6%; 34.5%; and 21.8, respectively<sup>33</sup>. According to the 2021-2022 Human Development Report, there is no overall estimation available for the extent of the population living below the poverty lines (national poverty line or PPP \$1.90 per day estimates).

33 UNICEF. 2019. "A Situational Analysis of Children in the Eastern Caribbean". <https://www.unicef.org/easterncaribbean/reports/situation-analysis-children-eastern-caribbean-area>

There is a direct correlation between poverty and unemployment - which in the case of Barbados is highly gendered. The national unemployment rate stood at 8.25% in 2016<sup>34</sup>. The 2016 Barbados Survey of Living Conditions also shows that 21% of women live in poverty when compared to 14% for their male counterparts<sup>35</sup> whereas unemployment rates amongst women is 0.8 percentile points higher than for males<sup>36</sup>. Child poverty rates by the gender of the

34 The World Bank. 2022. "World Development Indicators. Datasets ranged from 1997-2021.

35 The Barbados Survey of Living Conditions 2016-2017

36 The Barbados Statistical Service. 2022. "Unemployment rate". <https://stats.gov.bb/?s=unemployment+rate>. The unemployment rate among women is 14.5 percent compared to 13.7 percent among men.

head of the household within Barbados reinforce this point. According to the UNICEF report, entitled 'A Situational Analysis of Children in the Eastern Caribbean', poverty amongst children from female headed households stood at 40.8% - 11 percentile points higher than in male dominated households.

As a percentage of the Barbadian labour force, unemployment rates amongst adult women and men differed by approximately 4 percentile points. According to the 2016 Barbados Survey of Living Conditions, unemployment rate amongst adult women was higher (8.65%) than in adult males (7.85%). Similarly, youth unemployment amongst females was higher (28.35) than in males (25.13). In terms of the Labour Force Participation Rate, the overall ratio of females to males was 89.23% with minimal variation amongst the working-class females (61.87%) and males (69.34%).

Poverty amongst children within the Eastern Caribbean is well documented. In 2019, it was estimated that 32.6% or one in every three children live in poverty<sup>37</sup>. Children often bear the burden of poverty and are frequently neglected. The prevalence of child poverty "limits children's access to vital resources - including safe, nutritious and sufficient food, water and sanitation; early childhood care and development programmes; quality education; as well as health care and social services," (UNICEF, 2019). To address this, the Convention on the Rights of the Child entitles children from the ages 0 to 7 to an adequate standard of living, reiterating that growing up in poverty violates their rights. According to the UNICEF report, entitled 'A Situational Analysis of Children in the Eastern Caribbean, poverty amongst children can be disaggregated into child indigence and the overall child poverty rate. In Grenada, child poverty (50.9%) was the highest within the Eastern Caribbean Area. Within the aforementioned UNICEF report, corresponding data for Barbados was derived from the 2016 Barbados Survey of Living Conditions. For Barbados, the child poverty rate (35.6%) and the child indigence rate (6.4%) demonstrated that children are more likely to live in poverty and face multiple deprivations.

### 1.3.6 Education

The Sustainable Development Goal 4 (SDG 4) seeks to ensure inclusive and equitable quality education and to promote life-long learning opportunities for all. Since the achievement of independence, the GoB has reaffirmed its commitment to its most

valuable asset - human resources. It has dedicated a substantial portion of its expenditure to all levels of education. This investment allows for the provision of free education at the primary and secondary levels and heavily subsidised tertiary education (Government of Barbados, 2018). Enrolment in a formal education system is mandatory for children up to the age of sixteen (Government of Barbados, 2018; UWI, 2012). To date, the island has one of the highest levels of education attainment amongst neighbouring Caribbean states. The Education net enrolment in Barbados is well above 90% for both primary and secondary education; however, for pre-primary buttresses at 80%<sup>38</sup> with an Early Childhood Development (ECD) index of 96.6.3<sup>39</sup>. In 2015/2016, there were 77 public and 36 private pre-primary education institutions with 5,966 students enrolled. There were also 68 public and 26 private primary schools with 20,148 students enrolled. Similarly, there were 22 public and 9 private secondary schools with 20,370 students enrolled. As a measure of access to online learning resources, approximately 82% of Barbadians had access to the internet in 2017. In addition to this, tertiary education is not mandatory, but is free.

The SDG Target 4.3 seeks to ensure equal access for all women and men to affordable quality technical, vocational, and tertiary education, including university by 2030. The education of women marginally exceeds that of men, where 93.0% versus 90.6% reach a secondary or higher level of education (UNDP, 2020). Despite this, Barbados has shortages of skilled labour, particularly in the environmental, agro-industry, agriculture, fisheries, housing and building industries (Government of Barbados, 2018). According to the 2021-2022 Human Development Report, the Expected Years of Schooling in Barbados is 15.7. Similarly, the SDG Target 4.6 seeks to ensure that all youth and a substantial proportion of adults, both men and women, achieve literacy and numeracy by 2030. In Barbados, the Mean years of Schooling is 9.9 and the island boasts of having one of the highest literacy rates in the Caribbean Region. The literacy rate for Barbados is 99.7% (Government of Barbados, 2018).

38 UNESCO. 2022. "Country Profile of Barbados". <http://uis.unesco.org/en/country/bb>

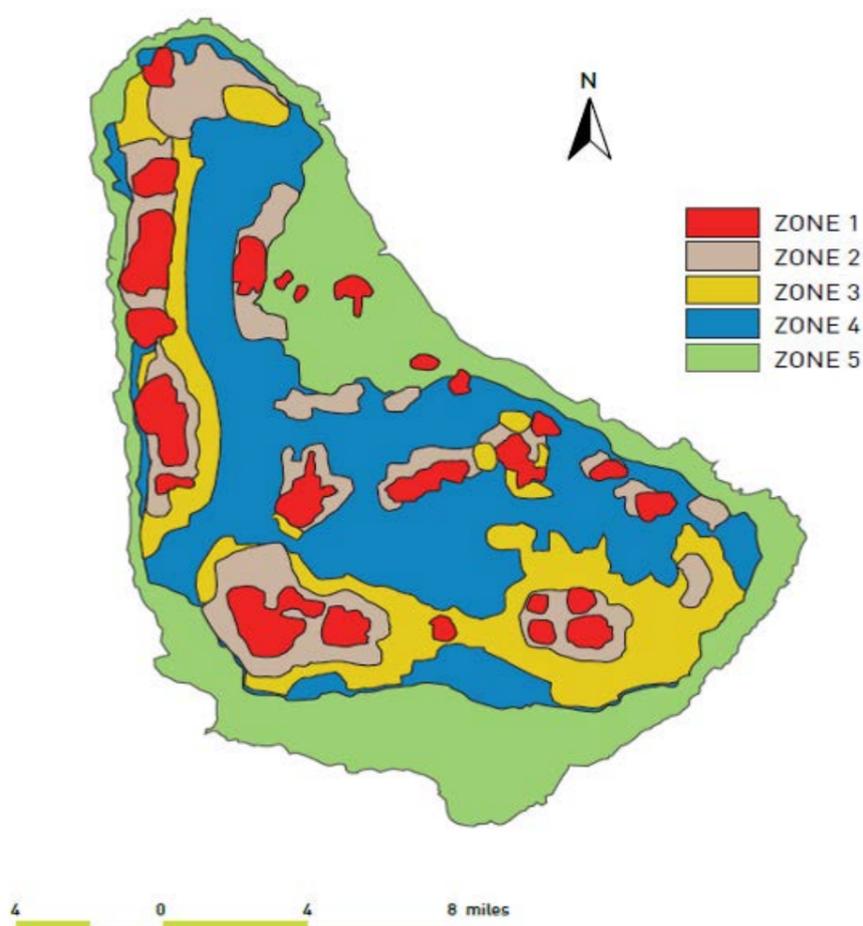
39 UNICEF. 2019. "A Situational Analysis of Children in the Eastern Caribbean".

37 UNICEF. 2019. "A Situational Analysis of Children in the Eastern Caribbean".

### 1.3.7 Water Security

Barbados is recognised as one of the top ten water stressed countries in the world<sup>40</sup> (FAO, 2016). Water security challenges on the island therefore present a major problem because of declining rainfall patterns<sup>41</sup>, competing needs at the private and public levels and the paucity of fresh waters resources on the island to supplement local needs. As a result, the population must rely solely on groundwater resources via aquifers for domestic and commercial uses. To protect groundwater resources against bacterial contamination, the Barbados' Groundwater Protection Zoning Policy was developed. Devised in 1963 and later revised in 1973, this Water Zoning policy was implemented by the Town and Country Development Planning Office (TCDPO) working primarily in collaboration with the Barbados Water Authority (BWA) and the Environmental Protection Department (EPD)<sup>42</sup>. The policy regulates the protection of water sources from environmental pollutants across five water protection zones, as seen in Figure 10.

Figure 10: Development Control Zone in Barbados



40 FAO. 2016. "FAO Water Reports: Drought characteristics and management in the Caribbean".

41 The IPCC predicts that across the Caribbean region, there will be a declining trend in rainfall during June–July–August that will continue in coming decades (high confidence at 2°C global warming and above).

42 The Government of Barbados. 2018. "The Barbados' Second National Communications to the UNFCCC".

These zones have been demarcated to allow varying degrees of physical development<sup>43</sup>- with 'decreasing stringencies from Zone 1 to Zone 5' (Moore et al., 2014, 37). The revised policy includes measures on private sewage and wastewater disposal systems, which provides control over any liquid waste disposal systems that could potentially damage the groundwater resources abstracted for domestic use. The overall policy is jointly supported by regulatory agencies such as the Barbados Water Authority, the Ministry of Health, and the Town and Country Development Planning Office (TCDPO) whilst issues regarding water quality fall under the mandate of the Barbados Water Authority and the Environmental Protection Department. To support this policy, regulation governing the distribution, cost, and availability of the critical resource to the general populace is recognized under the Barbados Water Authority (Water Services) Regulations.

### 1.3.8 Food Security

Barbados is generally characterized as a relatively low-lying country and the island's topography is directly correlated to soil development. This, coupled with limitations in its natural resource base, poses some restrictions on the nature of commodities and crops produced locally. Furthermore, persistently low rainfall patterns - even in the designated wet season<sup>44</sup> also exacerbate the situation as the island mainly depends on aquifers for its water supply. According to the IPCC's climatic projections, the Caribbean region is expected to receive less rainfall in the near future. This therefore has the potential to comprise efforts made by the GoB to firstly meet local food demands, then regional and international demands. In recent times, the government has prioritized local food production and a 25% reduction in the food import bill<sup>45</sup> noting the increasingly heavy reliance upon food imports<sup>46</sup>.

43 Zone 1 or Pathogen Exclusion Groundwater Protection Areas, Zone 2 or Pathogen Management Groundwater Protection Areas, Zone 3 or Chemical Management Groundwater Protection Areas; Zone 4 or Recharge Contributing Groundwater Protection Areas; and Zone 5 or Non-recharge Contributing Groundwater Protection areas. Zone 1 is the most restrictive due to proximity to drinking water production wells, whereas in Zone 5 the provisions for development are most relaxed.

44 From June to November.

45 In 2019, Barbados' Prime Minister, Mia Mottley, directly linked the revival of the CARICOM Single Market and Economy (CSME) to a reduction in regional food imports. In 2020, CARICOM Heads approved the Proposal of its Associate, the Caricom Private Sector Organisation (CPSO), to reduce food imports by 25% by 2025.

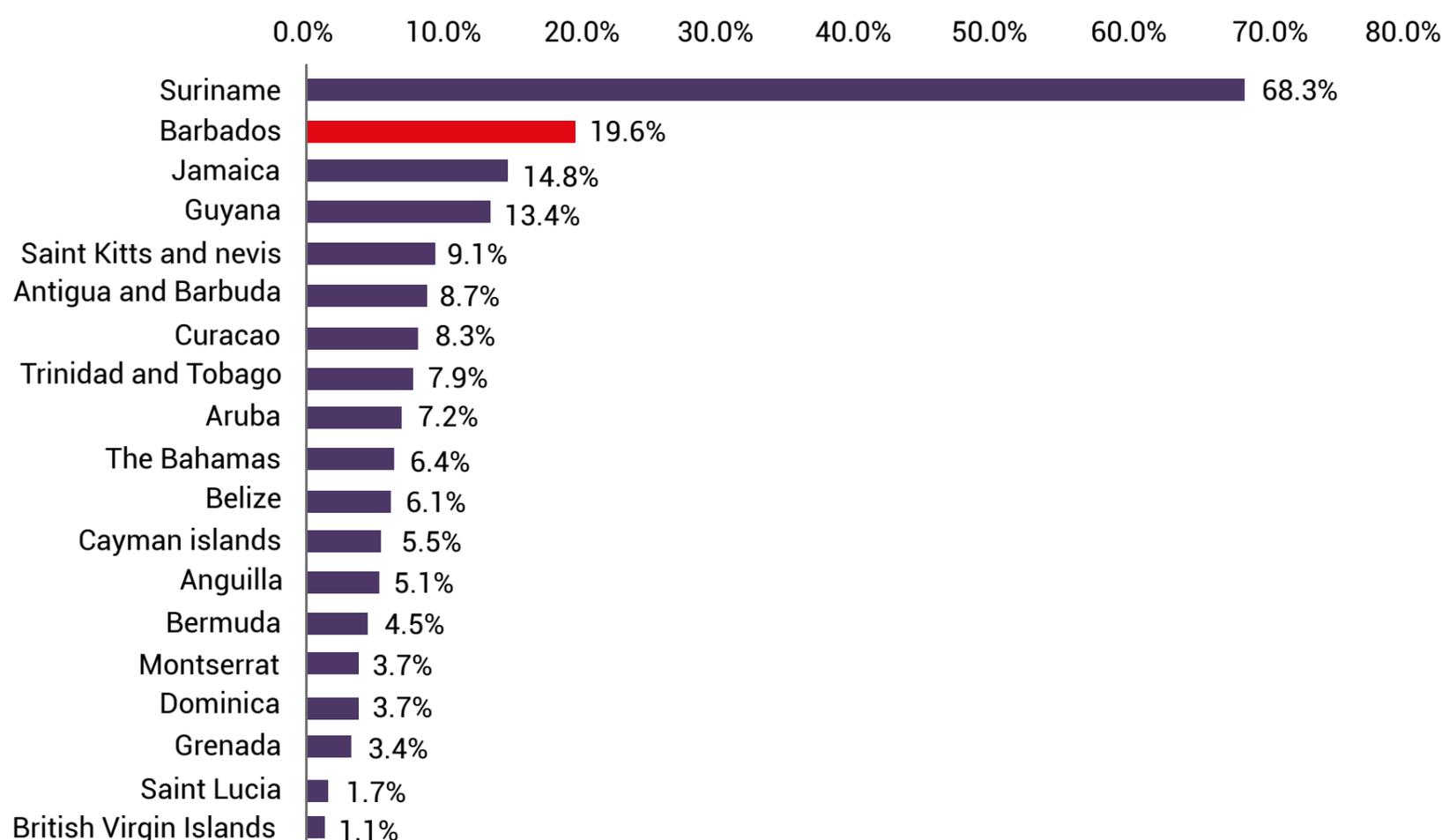
46 As of April 2021, the food import bill for Barbados was estimated at USD \$700 Million.

According to the Food and Drug Administration (FAO)'s Food Price Index, global food prices have sharply increased since the onset of the COVID-19 Pandemic. This exogenous price shock has in turn affected domestic food prices and has negatively impacted access to food by reducing one's purchasing power. Inflation statistics derived from the Food and Drug Administration Statistics (FAOSTAT) for March 2022<sup>47</sup> highlight the present-day scenario facing the English and Dutch-Speaking Caribbean - a 10.2% rise in food prices across twenty countries. As seen in Figure 11, food price increases are particularly alarming in Suriname (68.3%), Barbados (19.6%), Jamaica (14.8%) and Guyana (13.4%), where essential purchases became unaffordable for many.

To avert these risks, the GoB has sought assistance from CARICOM Member States with large natural resource bases - particularly Guyana<sup>48</sup>.

Such collaborations not only seek to strengthen intra-regional ties but also to boost the island's agriculture sector and to ensure the continuation and expansion of imports from Guyana to help meet local needs and demands<sup>49</sup>. Such efforts (in the form of technical assistance, technology transfer, knowledge sharing and capacity building) seeks to ensure that local farmers and producers secure greater access to food supplies - particularly the pest-resistant strains of commodities. Priority has therefore been given for aspects such as: (i) the improved used of technology within the agricultural sector; (ii) the modernization of praedial larceny legislation; (iii) crop insurance schemes; and (iv) regulations governing access to and the use of the natural resources. Such regulations are essential to address habitual practices at the community and household levels as well as the myriad of challenges faced by vulnerable groups - particularly the disabled community.

**Figure 11: Food Inflation across the English and Dutch Speaking Caribbean**



Source: CARICOM, CDEMA, WFP, FAO. 2022. "The Caribbean Food Security & Livelihoods Survey Report".  
 \*The inflation data refers to March 2022

47 CARICOM, CDEMA, WFP, FAO. 2022. "The Caribbean Food Security & Livelihoods Survey Report". <https://docs.wfp.org/api/documents/WFP-0000142384/download/>

48 BGIS. 2022. "Barbados & Guyana Working To Improve Food Security". <https://gisbarbados.gov.bb/blog/barbados-guyana-working-to-improve-food-security>

49 Department of Public Information, Guyana. 2022. "Guyana/Barbados food terminal critical to reducing region's food import bill - PM Mottley". <https://dpi.gov.gy/guyana-barbados-food-terminal-critical-to-reducing-regions-food-import-bill-pm-mottley/>

### 1.3.9 Energy Security

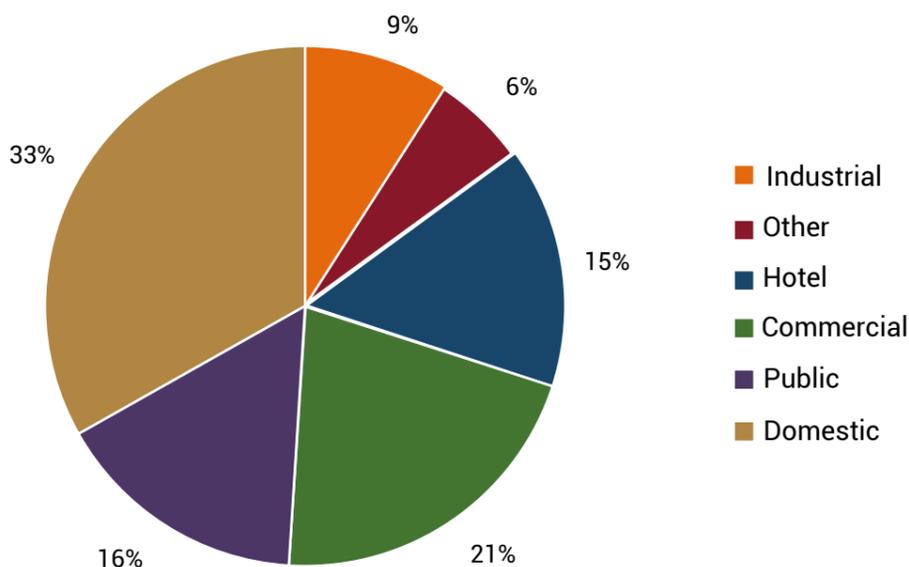
Owing to its small natural resource base and heavily dependence on external sources of energy, Barbados is highly vulnerable to oil price shocks. One of the global drivers of CO<sub>2</sub> emissions is the burning of fossil fuels. Reducing the growth in global CO<sub>2</sub> emissions is therefore only possible via alternative energy sources. The Sustainable Development Goal 9 (SDG 9) seeks to build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation. By 2030, its SDG Target 9.4 seeks to upgrade infrastructure and to retrofit industries thereby making them sustainable, with increased resource use efficiency and greater adoption of clean and environmentally sound technologies and industrial processes. For countries like Barbados, where there are limited domestically sourced fossil-fuels, renewable energies represent a key strategy to enhance sustainability and to adapt to climate change.

Electricity production in Barbados is largely fossil-fuel based. However, exogenous shocks in oil prices drive up local inflation because the spiralling cost of imported energy reduce purchasing power and limits a household's access to fuel resources. Of the more than 1000 GWh produced, more than 70% emerged from heavy fuel oil, with most of the remainder originating from diesel and a small proportion from AV jet. Relative to its counterparts across Latin America and the Caribbean as well as relatively more advanced economies, the percentage of merchandise imports in Barbados accounted for by fossil fuel imports can be two to three times higher.

In 2017, \$1 in every \$5 of imports in Barbados was spent on fuel. In 2012, this figure was as high as 31% of all imports. This fuel is largely used for electricity generation (48%) and transportation (31%)<sup>50</sup>. The cumulative impact of vehicular imports and the fuel intensity use are therefore likely to constrain the island's financial resources unless there is some fundamental change in the island's programme structure as it relates to transportation. Such action would allow for a greater rate of penetration of electric vehicles and renewables. As seen in Figure 12, the public sector accounts for 16% of total electricity demand in Barbados. This is largely due to street lighting, ports, reservoirs, and other general services. Due to the installation of PV systems, the public sector has been able to meet 1% of its consumption needs with renewable energy.

<sup>50</sup> Sustainable Energy for All. 2014. "Barbados Rapid Assessment Gap Analysis". <http://www.se4all.org/wp-content/uploads/2014/01/Barbados-Rapid-Assessment-gap-analysis-DET-PMO.pdf>

Figure 12: Electricity Demands in Barbados



Source: The Barbados National Energy Policy (2019-2037)

### 1.3.10 Housing

The Barbadian landscape has undergone significant demographic changes from a plantation economy to a more upscale urban society. There is adequate, durable housing of a permanent nature that protects against extreme climatic conditions (Barbados UNHABITAT, 2015). The 2010 Population and Housing Census reported that there were 94,173 dwellings when compared to 91,406 in 2000 and 82,204 in 1990. These estimates represent a 1% and 0.3% annual increase over the respective 10-year periods, (Government of Barbados, 2018).

### 1.3.11 Citizen Security

Vulnerable groups face intersectional challenges in their resilience building efforts. In recognition of this, the GoB through its ministerial arm: The Ministry of Empowerment and Elder Affairs and the Ministry of Home Affairs and Information have embarked upon initiatives to assist women, children, the elderly, and the disabled community. Such initiatives like the Disaster Social Relief Plan make provisions for individuals who require food, clothing or compensation in the aftermath of an emergency (Ministry of People Empowerment and Elder Affairs, 2022). Relief services detailed within the plan may be needed in the aftermath of incidents of limited scale as well as major emergencies or disasters. Several government agencies are assigned to provide Disaster Social Relief services as part of the national response and recovery mechanism. These include:

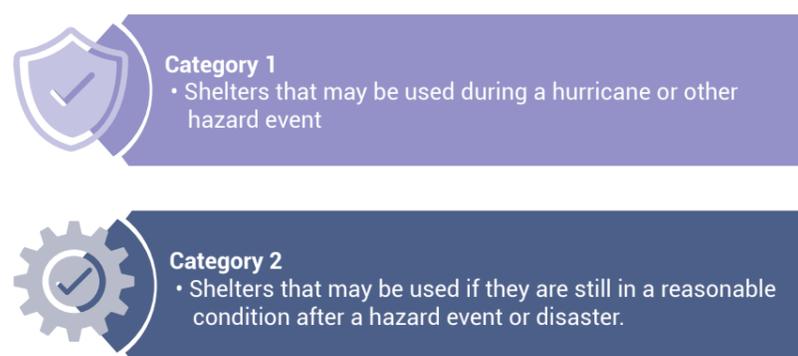
- The Ministry of People Empowerment and Elder Affairs (MPEA);
- The Ministry of Education, Technological and Vocational Training (METVT);

- The Ministry of Agriculture and Food Security (MAFS);
- The Ministry of Home Affairs and Information (MHA);
- The Ministry of Housing, Lands, and Rural Development (MHLR); and
- The Urban Development Commission (UDC) under the Prime Minister's Office.

Operationally, the response mechanism is divided into three (3) broad programmes, each geared towards a specific purpose yet simultaneously facilitating a holistic response to disaster relief efforts. These programmes include: (i) Disaster Social Relief; (ii) Food and General Supplies; and (iii) Housing Repair and Replacement. Another national initiative is the Barbados Companionship Programme which seeks to promote safeguarding but also greater community ties – particularly amongst those that considered isolated owing to the nature of their current living arrangements during the onset of the COVID-19 pandemic. Similarly, an Adopt-A-Family Initiative sought to address the economic devastation felt by the abject poor because of the suspension of tourism-related activities and the national lockdown. Even though the extent of the economic devastation facing households will tend to vary, the consequences of the COVID-19 pandemic resulted in a nearly four-fold increase in national unemployment.

Over the years, Barbados has established emergency shelters to facilitate the movement of and to ensure the safety of displaced persons during instances of inclement weather. Such facilities seek to provide temporary housing for persons who unable to remain within their current living arrangement, that is within separate family units or dwellings. Approximately 90% of all shelters on the island are wheelchair accessible. Historically, emergency shelters were generally comprised of churches, auditoriums and or educational facilities. Such facilities must undergo periodic assessments to ensure that they are not structurally compromised. Generally, shelters are either privately or publicly owned and can be utilised during or after the passage of the hazardous event or disaster. There are two (2) categories for emergency shelters on the island as seen in Figure 13.

**Figure 13: Shelter Categories in Barbados**



Source: The Department of Emergency Management

### 1.3.12 Solid Waste and Sewage Infrastructure

Barbados is regarded as one of the most densely populated societies in the Western Hemisphere. “Within the Eastern Caribbean, it is the most densely populated country in this sub-region, with just over a third of the population living in urban areas” (UNODC, 2020). The volume of solid waste and sewage generated therefore poses a significant challenge to disposal efforts on the island<sup>51</sup>. The Sanitation Services Authority is responsible for the collection and disposal of municipal solid waste and operates the island's Sanitary Landfill at Mangrove in the parish of St. Thomas. In addition to this, there are two government-operated sewage treatment plants in Barbados. They are located in Bridgetown within the Central Commercial District and in Graeme Hall along the south coast. There are also privately-operated sewage facilities on the island - either associated with hotels and gated communities. Such facilities retain and maintain their sewage treatment plants or septic tanks that are emptied by tanker. These tankers carry their loads to the South Coast Sewage Treatment Plant. Domestic and commercial properties not serviced by the two plants generally discharge their waste to suck wells or septic tanks, depending on the requirements for their location as detailed within the National Groundwater Zoning Policy.

### 1.3.13 Transportation

Barbados has a comprehensive transportation system for land, maritime and aerial operations. It is comprised of a 1,578-kilometre urban highway called the ABC highway that was originally conceptualized as a development measure to connect to the

<sup>51</sup> The Environmental Protection Department within the Ministry of Environment and Natural Beautification, and the Environmental Health Officers of the Ministry of Health are the regulators overseeing the operation and enforcement of all environmental issues pertaining to solid waste and sanitation

island's sole airport in Christ Church to its seaport in the capital city of Bridgetown, St. Michael. Since then, the ABC highway has been lengthened (with connections to all four of the major towns) and widened in 2007. Over the years, there has been an increase in the number of vehicles on the island<sup>52</sup> which creates traffic congestion, increases the likelihood of accidents, and threatens the health and productivity of the citizens as more pollutants are emitted into the atmosphere. There is also the issue of abandoned motor vehicles on the island. This constitutes as an eye-sore across the Barbadian landscape because it provides breeding grounds for pests and poses a general health hazard. From the ABC highway stems a diverse network of other highways and connecting streets that facilitate access to almost all parts of the island. Highway 1 and Highway 7 are two coastal highways that run along the breath of the north and southeast urban corridor extending from Bridgetown. To facilitate maritime operations, the main seaport was developed in the capital of Bridgetown. The sea port is comprised of a deep-water harbour that can accommodate large cruise liners and other commercial vessels. There are also two marina developments at Port St. Charles and Port Ferdinand in the north of the island. To facilitate aerial operations, the Grantley Adams International Airport, the sole airport on the island is a major hub for international travel, receiving flights from the United Kingdom, Europe, the Americas and the Caribbean. Irrespective of all the activity on the island, Barbados' carbon dioxide emissions are negligible relative to the world's carbon dioxide emissions.

### 1.3.14 Telecommunications

Barbados has a sophisticated information technology infrastructure. This stems from the existence of highly skilled yet small-medium sized enterprises that provide internationally accredited information technology services. In 2017, Barbados was regarded as the 43rd most connected country in the world and the country with the highest extent of connectivity across the Caribbean and South America (World Bank, 2021). In terms of telephone and internet connectivity, 81.76% of the population were deemed as active internet users in 2017 while it was reported that 45 users for every 100 persons had fixed line subscriptions in 2020.

<sup>52</sup> According to the Barbados National Assessment Report, 2010, (p.10), it was estimated that there were approximately 116,675 vehicles on the road; 81% of which are private cars. In October 2022, it was estimated that there were 131,000 registered vehicles on the island by the Barbados Licensing Authority.

## 1.4 Natural and Landscape Characteristics

Barbados is the most easterly of the islands of the Caribbean, located at 130 N, 590 W, approximately 160 kilometres from the nearest landmass. The island is 34 km long and 23 km wide with a total land area of 430km<sup>2</sup>, 92km of coastline and an Exclusive Economic Zone (EEZ) of 167,000km<sup>2</sup>. An examination of the natural and landscape characteristics can be divided into climatic conditions, geologic structure, and topography.

### 1.4.1 Climate

The Barbadian climate is classified as dry sub-humid with temperatures between 20° Celsius and 30° Celsius. There is a distinct dry season from December to May and a wet season from June to November. The average annual rainfall is about 50 inches (1254 mm) in the lower elevations and about 66 inches (1650 mm) in higher elevations. Most locations receive between 56 and 60 inches of rainfall annually. Recognised by the FAO as one of the top ten water stressed countries<sup>53</sup> in the world<sup>54</sup>, there is little surface water on the island, with small surface streams primarily found in the Scotland District region. The island is therefore almost completely dependent upon groundwater abstracted from the aquifers on the island. The northern and eastern coasts of Barbados are exposed to intense wave action and strong currents from the Atlantic Ocean which are characteristically distinct from the calmer western coast that is impacted by the Caribbean Sea. Coral reefs surround most of the island, extending up to 3 km seawards in some areas, and resulting in fine, white sandy beaches<sup>55</sup>.

### 1.4.2 Geologic Structure

The island is subdivided into two main geological regions. Eighty-six percent is composed of a karst landscape of deeply fractured and gullied limestone laid down in a series of terraces, deeply incised by numerous gullies and underlain by a complex underground cave system. The remaining land area consists of the sedimentary deposits of the Scotland Series. The island is relatively flat, with the highest point being Mount Hillaby at 336m (1,104 ft).

<sup>53</sup> FAO. 2016. "FAO Water Reports: Drought characteristics and management in the Caribbean". The Food and Agriculture Organization of the United Nations (FAO) defines countries like Barbados, Antigua and Barbuda, and St. Kitts and Nevis as water-scarce with less than 1000 m<sup>3</sup> freshwater resources per capita.

<sup>54</sup> The World Bank. 2022. "Climate Change Knowledge Platform". <https://climateknowledgeportal.worldbank.org/country/barbados/vulnerability>.

<sup>55</sup> Government of Barbados. 2018. "The Barbados' Second National Communication to the UNFCCC"

### 1.4.3 Topography

The Barbadian coastline, which spans 92 km, has an interesting diversity of land and seascapes - a unique and irreplaceable asset. The eastern and western coasts of the island are vastly different. The eastern side of the island faces the trade winds and is continually subjected to high wave energy. As a result, this region contains the most rugged elements of the coastal landscape. Reef development is minimal offshore but there are extensive areas of limestone pavement dominated by sea fans. On the western side of the island facing the Caribbean Sea, there are protected bays and shorelines which marked the preferred sites for trade, commerce, and early settlement. In recent times, sandy beaches, coral formations, and calm waters have become the focal points of the tourism industry. To compliment this type of commercial activity, industrial facilities are in close proximity to this shoreline.

### 1.4.4 Biodiversity

Barbados has a small natural resource endowment. The first European settlers arrived in Barbados in 1627 and discovered that most of the island was covered with forests. However, within the span of 30 years about 80% of the forested area was cleared for agriculture (Watt, 1966). This, coupled with extensive monocrop agriculture, developmental activities including tourism, residential and commercial developments have all contributed to the decline of biodiversity on the island. The remaining natural vegetation is found within natural plant communities and man-made habitats. These include beaches; sand dunes; sandy bushlands; sea cliffs; rocky and inland cliffs; gullies; forests and coastal wetlands plantation forest; sugarcane plantations; pastures; cane field roads; roadsides; ponds; streams; and miscellaneous waste sites.

Figure 14: Physical Map of Barbados



Source: <https://www.worldometers.info/maps/barbados-map/>

# Disaster Risks for Barbados

## Chapter 2 Overview

This chapter provides a synopsis of the Disaster Risk profile for Barbados. Even though the island is generally considered as an outlier within the Caribbean Archipelago, Barbados has been subjected to an array of intra-island and inter-island hazards to varying degrees. Such hazards stem from either a hydrometeorological, geological, environmental, chemical, biological, technological and societal basis.

The prevalence of budgetary constraints, weak institutional capacities, limitations in technical expertise and a general paucity of knowledge and coordination of effective disaster preparedness and disaster response measures can limit a society's adaptive capacity. This in turn can highlight pre-existing and potential vulnerabilities within the Barbadian context such as fragility, susceptibility or lack of resilience with and across sectors and associated with cross-cutting issues like water, energy and waste. Such vulnerabilities stem from either a social, economic, physical, environmental, political, ideological, educational and institutional basis. Ultimately, food, water and energy insecurities pose significant challenges for the island.

An exceedingly high level of indebtedness has precluded Barbados from various tranches of developmental assistance – a necessary requirement to effectively address developmental concerns such as adaptation, mitigation and loss and damage. The island's close proximity to the Lesser Antilles Subduction Zone has rendered it susceptible to volcanic and seismic activity. Similarly, Barbados is also high susceptible to tropical cyclone activity noting the westerly track of all hydrometeorological systems. The island is relatively flat in comparison to its neighbouring territories. It is therefore highly prone to climate and disaster risks like sea level rise that is associated with cascading hazards and impacts. These hazards and associated impacts have the potential to compromise the current standard of living, level of commerce as well as the quantity and quality of ecosystem services – particularly those related to key economic sectors like tourism, agriculture, and fisheries – the lifeblood of the Caribbean people. Ultimately, underlying factors such as poverty, land degradation and conflicts aggravate exposure and vulnerability to climate-related and man-made hazards.

## 2. Disaster Risk Profile

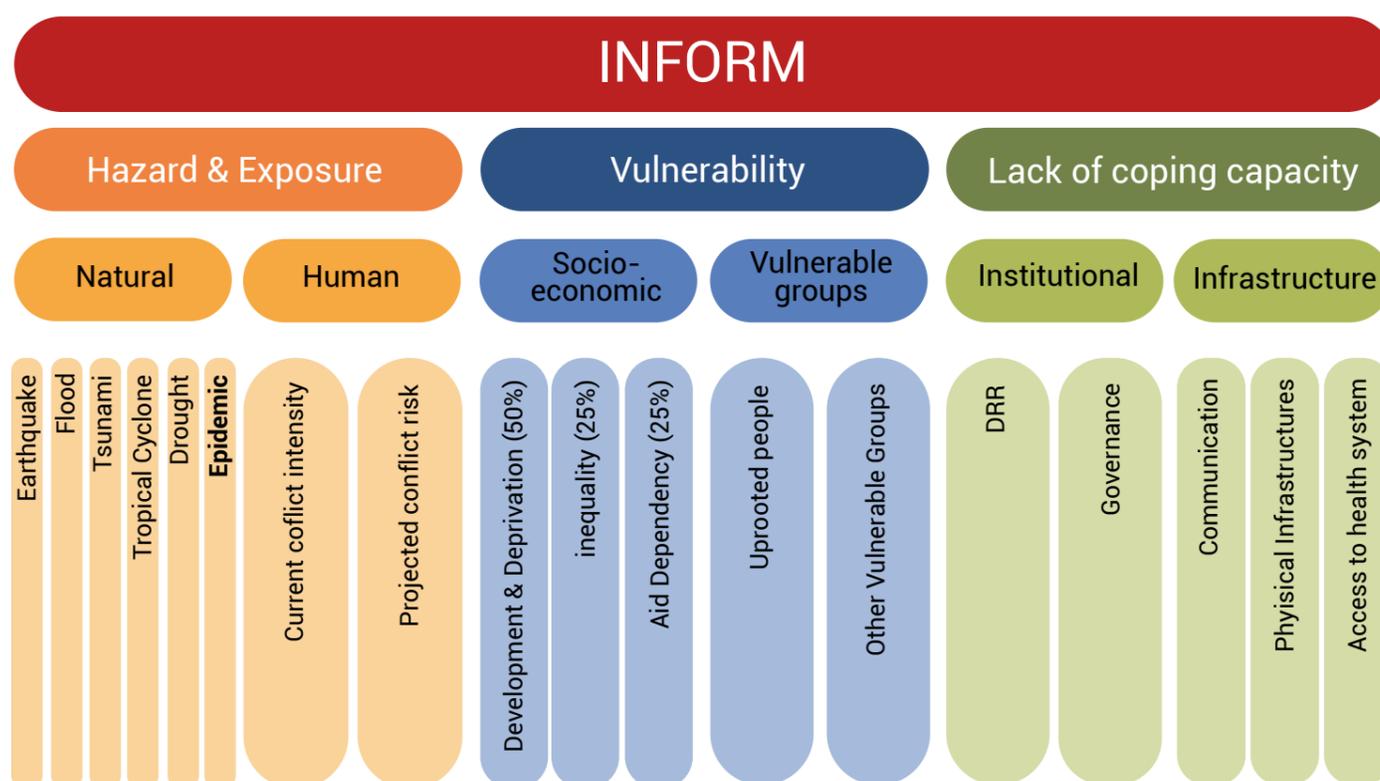
The Inform Risk Index<sup>56</sup> is a globally recognized transparency tool for understanding the risk of humanitarian crises and disasters within a given country context. The Inform Risk Index seeks to identify countries that are characterized as high risk for humanitarian crises that are also more likely to require international developmental assistance. The Inform Risk Index therefore aids policymakers in identifying where and why crises might occur, facilitating measures to reduce the risk, building resilience and adequately preparing for when crises do arise.

The Inform Risk Index examines three (3) dimensions of risk: (i) Hazard and exposure; (ii) Vulnerability; and (iii) Lack of Coping Capacity. These dimensions, which rank risks on a scale of 1 (very low risk) to 10 (very high risk)<sup>57</sup>, can be further disaggregated into various subcomponents of risk, as seen in Figure 15.

<sup>56</sup> The Inform Index for Risk Management, 2022.

<sup>57</sup> Inform Risk Index Values: 0–2: Very Low 2.1–3.5: Low 3.6–5: Medium 5.1–6.5: High 6.6–10: Very High

Figure 15: Dimensions of Risk under the Inform Risk Index



Source: The Inform Risk Initiative

In 2022, Barbados attained an overall rank of 156 out of 191 countries on the Inform Risk Index. During such time, the country was classified as 'low risk' having obtained an overall risk score of 2.0 – well below the average risk score of 3.57 for the America<sup>58</sup>. The Hazard and Exposure Dimension considers risks arising from anthropogenic or natural hazards as well as the extent of the exposure to such risks. Barbados attained a score of 2.1 (very low) citing geological hazards like tsunamis (5.7) and earthquakes (5.6); hydrometeorological hazards like tropical cyclones (4.6); and anthropogenic hazards such as epidemics (4.2) and natural phenomena (3.6) as primary concerns. Even though the topography of country is considered as to be relatively low-lying, the hazard risk score associated with flood impacts was 0.1. The Vulnerability Dimension offers insight into the social, economic, environmental, and physical characteristics that can be destabilized in the event of a hazard occurrence. Overall, the island attained a vulnerability index score of 1.5 (very low) citing inequality (3.4); development and deprivation (2.6); socio-economic constraints (2.3); food security (2.2); exogenous shocks (1.1), the well-being of infants (0.8) and vulnerable groups such as the elderly and children (0.6) and other vulnerable groups - those compromised medical or physiological conditions (1.1) as primary areas of concern. Adaptive capacity refers to the resilience of a system. This is achieved by assessing the extent with which a system can adjust to climate variability and extremes in attempts to mitigate

potential risk to human, technical, institutional, and infrastructural capacities. Adaptive capacity also requires that the system to take advantage of opportunities as they arise and to cope with the consequences. Within a given country context, the extent of adaptive capacity underscores issues that the government has addressed to increase the resilience of the society and level of success associated with these implementation measures. In this context, a high adaptive or coping capacity therefore assesses the national characteristics - particularly as it relates to institutional (the existence of DRR programmes which mainly address mitigation and emergency preparedness/early warning mechanisms) and infrastructural arrangements (the capacity for emergency response and recovery) that aid in reducing disaster risk. A low adaptive capacity highlights the extent of government failure in adequately promoting disaster risk reduction efforts. For the Lack of Coping Capacity Dimension, Barbados attained an overall score of 2.5 (very low). As it relates to Infrastructure, the primary area of concerns were Communication (1.6) and Physical Infrastructure (0.2) whereas Access to Health care attained a measure of 3.1. The overall score for Institutional arrangements was 3.3, with low and medium scores being recorded for Disaster Risk Reduction (2.7) and Governance (3.8). Despite these values, caution should be exercised in underestimating the nature of risk and the detrimental impacts that hazards can pose on the country. Appendix I outlines the risk component data available for Barbados.

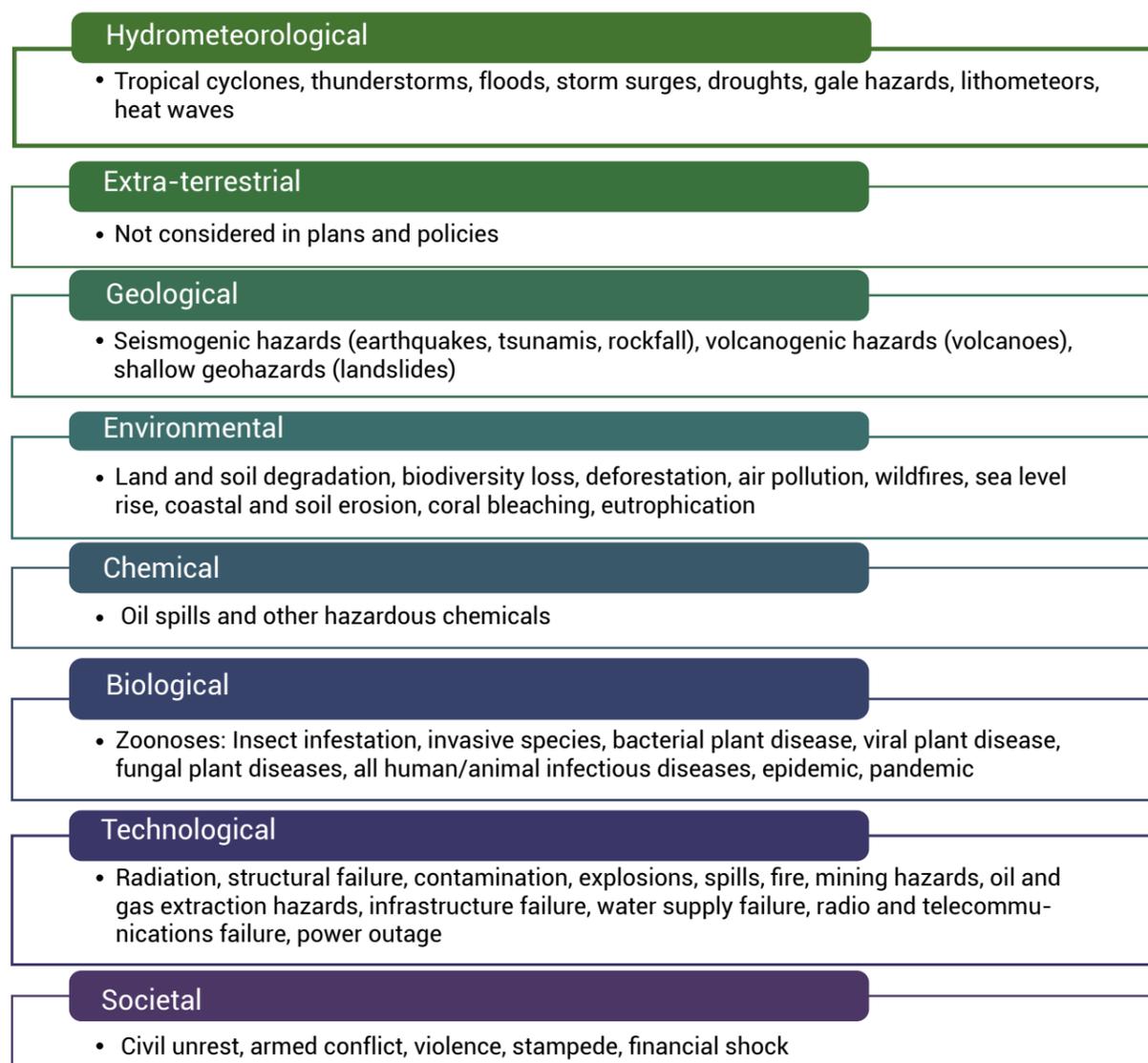
58 The Inform Report 2022

## 2.1 Hazards

Barbados' geographical location, topography and anthropogenic practices create an intricate risk profile. Hazards, when realized resulted in loss of life; damaged infrastructure and ecosystems; the disruption of livelihoods that are limited in diversification; and disrupted economies. Barbados has had its fair share of hazard impacts. Hazard threats posed include natural and anthropogenic hazards; climate change; land degradation; oil spills; chemical and groundwater contamination, informal settlements, wildfires; zoonoses; epidemics and pandemics. The most common type of hazards affecting Barbados are floods, droughts, and tropical cyclones (storms and hurricanes). Historical data shows that the island has been susceptible to a wide range of intra-island and inter-island hazards to varying degrees. Recent trends suggest an increasing risk profile for the island. The subsequent paragraphs explore the hazard profile for Barbados. To assist in the development of this hazard profile, hazards are considered based on the inclusion criteria outlined within the 2020 United Nations Hazard Definition and Classification Review Technical Report. This criterion utilizes eight (8) hazard clusters as depicted in Figure 16:

- i. The hazard has the potential to impact a community: This criterion puts the focus on those hazards that may have an effect at the population or community level and thus require system-wide risk management measures, as distinct from hazards that may have serious consequences for individuals concerned and where risk management measures tend to be focused on the individual level.
- ii. Proactive and reactive measures are available: This criterion reflects the need to implement practical risk management measures to prevent new and reduce existing and residual risks (i.e., before, during and after hazardous events), and to address the dynamic nature of evolving risks. It also implies that proactive and reactive measures could be developed or applied in future.
- iii. The hazard has measurable spatial and temporal components: This criterion reflects that hazardous event (including disasters) are manifestations of hazards and have temporal and spatial dimensions.

**Figure 16: Summary of documented hazards for Barbados under the United Nations Hazard Definition and Classification Review Technical Report**



## 2.1.1 Hydrometeorological Hazards

This section provides an overview of the nature and extent of hydrometeorological hazards for Barbados. Such hazards include tropical cyclones and their associated effects like floods and extensive rainfall which are well-documented and realized hazards within the country context. According to the World Bank's Climate Change Knowledge Platform, storms and floods collectively accounted for 70% of the average annual hazards occurring over the period 1980-2020 (World Bank, 2022). During the progression of a hydro-meteorological system towards Barbados, it is often classified as a tropical storm – a weaker hydro-meteorological system in terms of its associated effects. However, the economies of Antigua and Barbuda, the Commonwealth of Dominica, Grenada, and Jamaica often experience intensified hydro-meteorological elements associated with tropical cyclones. Historically, Barbados experienced 34 hazard events of this nature between the late 1600s and 2000s<sup>59</sup>. Over the period, the total number of recorded storms was 14 and extensive flooding events were rare. Of these events, the island has experienced seven storm events during the period from 1955-2015<sup>60</sup>. Historical data on the extent and nature of hydrometeorological hazards in Barbados can be seen in Table 5.

**Table 5: Historical Data on Hydrometeorological Hazards in Barbados**

Timeframe	Nature of Hazard	Events
Late 1600s	Tropical Cyclones	4
1700s	Tropical Cyclones	1
	Wind	1
1800s	Tropical Cyclones	9
	Storm	8
1900s	Tropical Cyclones	3
	Storm	3
	Flood	4
2000s	Tropical Cyclones	2
	Storm	4
<b>Total</b>		<b>34</b>

Source: The Department of Emergency Management; EM-DAT international Database for Disasters; The Barbados Meteorological Services; The Barbados Museum

<sup>59</sup> See Appendix XIII for Hurricane Impacts during the colonial era prior to 1949.

<sup>60</sup> The World Bank. 2022. "Climate Change Knowledge Portal: Country profile - Barbados". <https://climateknowledgeportal.worldbank.org/country/barbados/vulnerability>

## Tropical Cyclones, Thunderstorms, Floods, Storm Surges and Gale Hazards

In the late 1600s, there were four recorded hurricanes. In December 1660, extensive infrastructural damage at the seaports was noted as vessels ran aground. During August 1674 and 1675, the island experienced two very intense hurricanes. Particularly in 1674, the system led to the destruction of 300 buildings, 200 deaths and total devastation of the main agriculture commodity on the island at the time – sugarcane. This resulted in long terms secondary effects as the production of the commodity was halted for two years. In October 1694, a weak system passed Barbados; yet was able to throw ships ashore.

In the 1700s, the frequency of recorded hydrometeorological events was less in contrast to the 1800s in which 13 events were recorded. However, the extent of the damage experienced in October 1780 was significant for the island and amounted to £1 million in damages at that time. Barbados was under threat for a period of two (2) days and the total lives lost were 4,326. Similarly, in September 1786, a severe gale wind was experienced. This shifted every ship on the harbours ashore; posed great damage to homes, infrastructure as well as crops; and resulted in several lost lives.

The 1800s was associated with significant meteorological activity. During this period, the frequency of tropical storms and tropical cyclones was almost the same. Due to its low terrain, coupled with poor drainage and lack of inadequate storm water infrastructure, Barbados is susceptible to flooding. Low-pressure systems such as tropical storms bring torrential rainfall often cause flooding in areas of the west and south coast where approximately 25% of the population resides (World Bank, 2022). For instance, a storm experienced in August 1855 killed 3 persons, caused major infrastructural damage, and deposited significant amounts of rain in Edgecombe (9 inches) and Bayfield (10.36 inches) in St. Philip. Similar effects were observed in 1872 during a severe thunderstorm which deposited between 8.01 and 11.02 inches of rainfall. Events in 1894 resulted in the loss of life for several fisherfolk. Overall, the intensity of tropical cyclones was quite severe even by present day realities - particularly those experienced in 1819, 1831, 1886 and 1898. Such hazards, which occurred in the months of August and October, all veered northward and resulted in extensive damage. Impacts in 1819 included two (2) deaths; extensive rainfall; landslides in Foster Hall, St. Joseph; and wrecked ships. The total estimated damage by a

tropical system in 1831 amounted to over £2 million and resulted in 1,525 lost lives. Even though the system passed 40 mile north of Barbados in 1886, it was associated with gale force winds; deposited between 7 to 9 inches of rainfall; and caused floods within St. Michael and landslides within St. Joseph and St. Thomas<sup>61</sup>. The most severe yet unusually tropical cyclone was experienced in September 1898. This system passed to the south resulting in 83 deaths; destroyed 9,937 homes; extensively damaged 4,519 homes; and left 50,000 people homeless.

In retrospect, the 1900s was classified as a relatively calmer timeframe for activity than the previous century. The frequency of tropical cyclones, storms and floods was 3; 2; and 4, respectively. At the start of the century, a tropical storm in 1901 veered southward. It deposited approximately 20 inches of rain in St. Peter and killed one person. Similarly, a tropical storm in 1949 deposited 10 inches of rainfall in St. Joseph, St. John, St. Thomas, and St. George; with fewer inches (5 to 6 inches of rain) in the north even though it was classified as a weak disturbance. On September 21st in 1955, a tropical storm originating 600km to the east of Barbados formed across the Atlantic Ocean for what some deemed a usual occurrence within the Atlantic Hurricane season. With limited warning and preparation as well as a general lack of understanding of hydrometeorological hazards - particularly as it relates to 'protocols during the calm of the storm', the tropical storm transitioned to a Category 3 Hurricane. It severely impacted the southern part of the Barbados (mainly Silver Sands, Christ Church and others portions of St. Philip) and was associated with sustained speeds of 120 miles per hour. Similar, yet less catastrophic effects were felt in the northern portion of the island, where 60 miles per hour gusts were reported. This hurricane left a large path of devastation on the island to the extent that it was declared as a National Emergency. Upon leaving Barbados, the hurricane (now Category 4) remained on the usual westward track across the Caribbean Region where it posed devastating impacts to the economies of St. Lucia, St. Vincent and the Grenadines, Grenada and whilst over the Caribbean Sea, the hurricane continued to fluctuate between Category 4 and Category 5 on its approach

<sup>61</sup> Though uncommon, landslides can occur with heavy rainfall from passing low-pressure systems. Small-scale landslides have occurred in the Scotland district, which is located on the northeast portion of the country. Earthflows, slumps and debris flows are the main types of landslides that occur in the Scotland District.

to the Yucatan peninsula. The hydrometeorological system made landfall in Veracruz, Mexico as a Category 5 system on September 30th, 1955. It later dissipated as it moved further inland. Hurricane Janet was deemed the most powerful Hurricane during the 1955 Atlantic Hurricane season – and up until recently - the most powerful hurricane to make landfall in Barbados.

There were a series of floods in August 1949 (41 lost lives); October 1970 (3 lost lives) and October 1984 (7 lost lives) that resulted in major economic losses between USD \$500,000.00 to USD \$2,000,000.00 across several sectors – particularly infrastructure (buildings, roads, bridges); fisheries; agriculture (soil erosion); electricity; water and telecommunications. The tropical depression experienced in October 1970 resulted in extensive flooding in St. Michael – particularly in Bridgetown: the island's Central Commercial District. The 1980s was associated with extensive economic losses. In August 1980, Hurricane Allen – the second most severe Atlantic hurricane veered towards the north of Barbados. The rate of trajectory of the system was unusually fast (approximately close to 23 miles per hour). Upon reaching Barbados, Allen was classified as a Category 3 system. The intensity of which was relatively unknown within the Barbadian landscape. It resulted in 7 lost lives; affected 5,007 persons and rendered 5,000 persons homeless. The main sectors impacted were housing, fisheries, and agriculture. Total economic losses amounted to US\$150,000.00. The floods of October 1984 were mainly associated with infrastructural damage amounting to USD \$2,000,000.00. The end of the 1980s was earmarked with the passage of Hurricane Emily in September 1987. It affected 230 persons, infrastructure (roads, bridges); the fisheries and agricultural sectors to a larger extent and disrupted the electricity supply and telecommunications. In August 1995, a flood resulted in one lost life and economic damages amounting to USD \$5,000,000.00. Tropical Storm Marilyn arrived in September of that same year.

During the early 2000s, there were four tropical storms and two tropical cyclones. Even though the intensity of tropical storms is deemed as negligible in comparison to the tropical cyclones, their associated impacts affected the highest numbers of persons within the given timeframe under study. All tropical cyclones and tropical storms affecting Barbados – except Tropical Storm Tomás, occurred in September. In 2002, Lili affected 2,000 people and amounted to economic losses of USD \$200,000. Tropical Storm Ivan in 2004 left a path of

destruction<sup>62</sup> affecting 800 people and rendered 880 homeless. The impacts of Tropical Storm Ivan were triple-fold in neighbouring Caribbean territories when it strengthened and became a tropical cyclone. For Grenada, it resulted in major economic collapse with economic losses amounting to 250% of the island's gross domestic product. In October 2010, Tropical Storm Tomás affected 2,500 persons and resulted in economic losses of US\$3,700,000 in Barbados. The most extensive damage was experienced in the parishes of St. Andrew, St. George, St. John, St. Joseph, and St. Michael. Since October 2010, Barbados received six substantive payments equalling USD \$19,304,211.00 (BBD \$38,608,422.00) – amounting to 14% all CCRIF payouts to deal with excessive flooding. During 2016-2018, USD \$8,484,082.00 (BBD \$16,968,164.00) – amounting to 24.45% of all Caribbean Catastrophe Risk Insurance Facility's (CCRIF) excessive rainfall policies were issued to Barbados<sup>63</sup> to provide relief in the aftermath of Tropical Cyclones: Matthew and Maria, and Tropical Storm Kirk (USD \$1,728,227.00 (BBD \$3,456,554.00); USD \$1,917,506.00 (BBD \$3,835,012.00); and USD \$5,813,299.00 (BBD \$11,626,598.00 respectively)<sup>64</sup>. In September 2017, Hurricane Irma caused major infrastructural damage; disrupted the fisheries and agriculture sectors as well as the water supply, power supply and communication channels. In September 2021, Barbados experienced its first Category 1 System: Hurricane Elsa in over 65 years. Most recent estimates on the extent of the devastation on the island (the number of persons affected and those rendered homeless<sup>65</sup>) was derived from the EM-DAT International Disaster Database system<sup>66</sup>. The DEM also provided initial estimates the day after the passage of the system<sup>67</sup>. The most extensive damage was experienced in the parishes of Christ Church, St. James, and St. Joseph.

62 The most extensive damage was experienced in the parishes of Christ Church, St. Andrew, St. George, St. James, St. John, St. Joseph, St. Lucy, St. Michael, St. Peter, St. Phillip, St. Thomas.

63 The Caribbean Catastrophe Risk Insurance Facility. 2017. "2016-2017 Annual Report". <https://www.ccrif.org/en/publications/annual-report/ccrif-spc-annual-report-2016-2017>

64 The Caribbean Catastrophe Risk Insurance Facility. 2017. "2017-2018 Annual Report". <https://www.ccrif.org/en/publications/annual-report/ccrif-spc-annual-report-2017-2018>

65 EM-DAT. 2022 "Custom Request for types of hazards affecting Barbados".

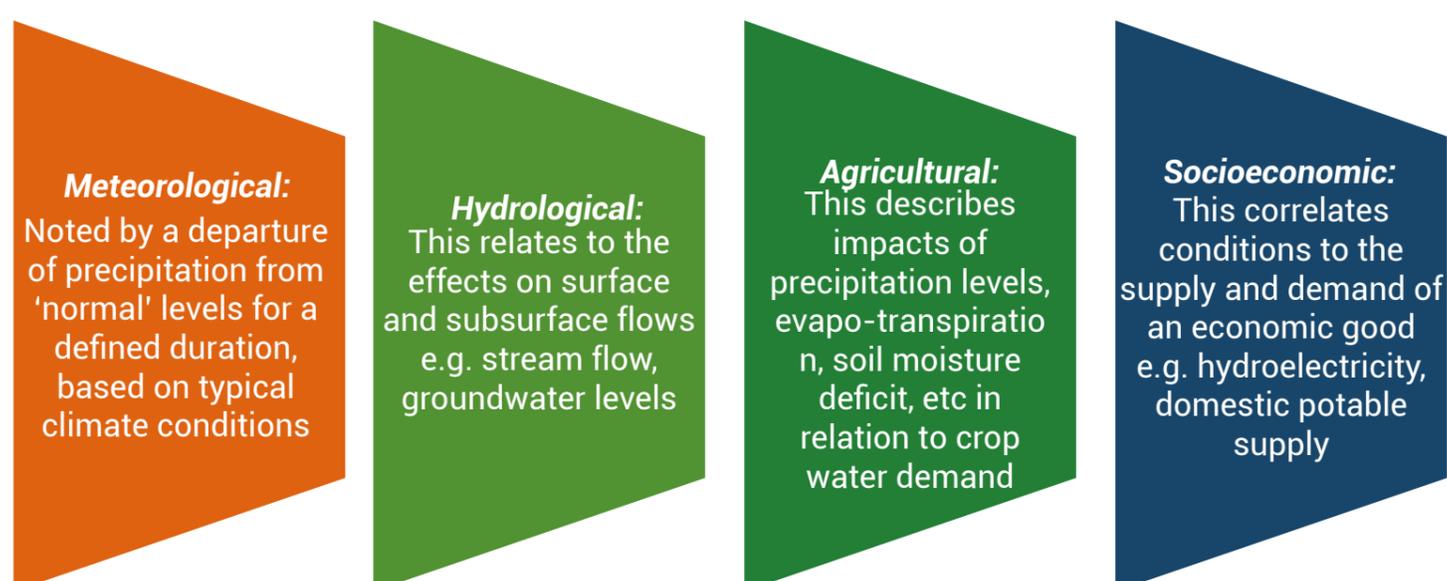
66 At the timing of this study, the final figure on the extent of the damage associated with the passage of Hurricane Elsa was not readily available.

67 BGIS. 2021. "DEM Reports on Damage From Hurricane Elsa ". <https://gisbarbados.gov.bb/blog/dem-reports-on-damage-from-hurricane-elsa/>. Initially, the Department of Emergency Management noted that 2,372 problems reported: (1,333 reports of roof damage; 326 reports of other house damage; 145 reports of total house collapse).

## Droughts

Barbados is characterized as 'severely water stressed' owing to its paucity of freshwater resources and sole reliance of groundwater resources (FAO, 2016). Droughts are characterized as a lack of precipitation over a protracted period resulting in a shortage in the water supply for residential and commercial purposes. The frequency of drought conditions in Barbados is 'approximately 3 in every 10 years' (DEM, 2014) and are usually correlated within El Niño events. Inadequate rainfall and longer drought conditions will affect water availability and adversely affect stability of water supplies (CDKN, 2014). Cognizant of the fact that droughts represent a relatively uncertain risk<sup>68</sup>, they are associated with 'social and economic impacts that disproportionately affect the rural poor' (UNISDR, 2011). Wilhite and Glantz (1985) has associated such phenomena based on pre-existing meteorological, hydrological, agricultural, and socio-economic factors<sup>69</sup>, as seen in Figure 17.

Figure 17: The Nature of Droughts



Source: Wilhite and Glantz, 1985

The drought experienced during January to June 2010<sup>70</sup> highlighted the detrimental impacts that this type of hazard poses to agriculture; food, water, energy and citizen securities; health; tourism; gender; poverty eradication; insurance for productive assets and overall development.

Droughts reduce crop yields. Even though agricultural sector plays a critical role in food and livelihood provisions (Farrell et al., 2010), Barbados' heavy reliance on rainfed agricultural production makes the sector particularly vulnerable to droughts (Climate Studies Group Mona, 2020). This hazard not only negatively affects crop production resulting in the abnormal development of foliage but also reduces the quality of hay - both of which are critical inputs for livestock. The prevalence of droughts will therefore adversely affect the nutritional value of feed for animals and compromise the nutritional quality of meat produced by these animals (Chapman et al., 2012; Climate Studies Group Mona, 2020).

Droughts threaten food security. Prolonged droughts can lead to malnutrition from disturbances in food production and ultimately food shortages. Rising food imports may lead to a higher prevalence of obesity in the population particularly amongst the youth because of the importation of calorie laden, high sodium foods (Silva, 2015).

68 United Nations Office for Disaster Risk Reduction (UNISDR). 2011. "Global Assessment Report on Disaster Risk Reduction: Revealing Risk, Redefining Development".

69 Wilhite, D. A. and Glantz, M. H., 1985, 'Understanding the drought phenomenon: the role of definitions'.

70 EM-DAT. 2022 "Custom Request for drought hazards affecting Barbados".

Droughts adversely affect the livelihood strategies of individuals within the agricultural sector. According to Farrell et al., 2010, agricultural employment accounts for at least 4.6% of total employment and contributed 4.4% to the gross domestic product of Barbados in 2009. The extent of agricultural land accounted for 19,000 hectares whereas irrigated land accounted for 9% of the total cropland. The prolonged drought in the Caribbean resulted in reduced agricultural production for Barbados and hence compromised the overall profitability of the sector which is directly correlated to rainfall variability and rainfall extremes.

Droughts compromise water security. Such hazards result in severe dehydration in humans and livestock; create phytosanitary challenges within daily activities; and magnify medical complications for particular segments<sup>71</sup> of the Barbadian population and ultimately death in extreme cases. Countries like Barbados with predominantly groundwater resources are impacted after a longer time than surface water, due to lack of evaporative losses, but can suffer from over pumping during drought, at times being infiltrated by saline water, reducing its quality (Farrell et al., 2010). During the 2010 Drought, water levels within aquifers across Barbados were significantly low and this prompted the Barbados Water Authority to implement Stage 1 of its Drought Management Plan in March 2010. This strategy sought to urge customers to engage in good water use habits and to employ voluntary conservation measures (Farrell et al., 2010).

Droughts affects sanitation and lead to an increase in the prevalence of pathogenic and parasitic populations as well as the emergence of new pests (Henry et al., 2012; Thornton et al., 2009; Rojas-Downing et al., 2017; Climate Studies Group Mona, 2020). Prolonged water storage during drought periods create suitable habitats of vectors such as mosquitoes thereby giving rise to more vector-borne diseases such as dengue fever and chikungunya that are likely to increase with high temperatures.

Droughts affect the reliability of energy supplies. In Barbados, increased evaporation, and drought may increase the need for employing energy intensive methods for instance desalinization to meet critical needs such as consumption and irrigation (Climate Studies Group Mona, 2020). Irrigation water may also have to be pumped over longer distances,

further increasing energy demand (Climate Studies Group Mona, 2020).

Droughts highlight and potentially exacerbate underlying gender disparities. Barbados is deemed as a matriarchal society and prolonged instances of drought are not only deemed as time-consuming but also result in the reallocation of time and effort that could otherwise be devoted to income-generating activities.

Droughts exacerbate poverty and disease transmission as a result of poor infrastructure, waste disposal issues and a general lack of access to clean water resources (Silva, 2015; Climate Studies Group Mona, 2020). This is particularly challenging for disadvantaged groups like the elderly, children, women and the disabled community within rural communities (UNECLAC, 2011).

Droughts compromise the quality of educational facilities resulting in adhoc educational procedures, curriculums, examinations and ultimately school closures. The 2010 Drought disrupted schools in Barbados due to the lack of water for hygiene and sanitation (Climate Studies Group Mona, 2020).

Droughts derail developmental outcomes achieved thus far and negatively impact key economic sectors particularly climate sensitive ones like tourism and agriculture. Prolonged drought emphasizes alternative measures to address food security challenges in a water stressed country like Barbados. Since the Barbados Green Economy Scoping Study, several efforts have been made to promote awareness of rainwater harvesting techniques for non-potable water activities. These activities include lavatories, landscape irrigation, swimming pools and laundry facilities.

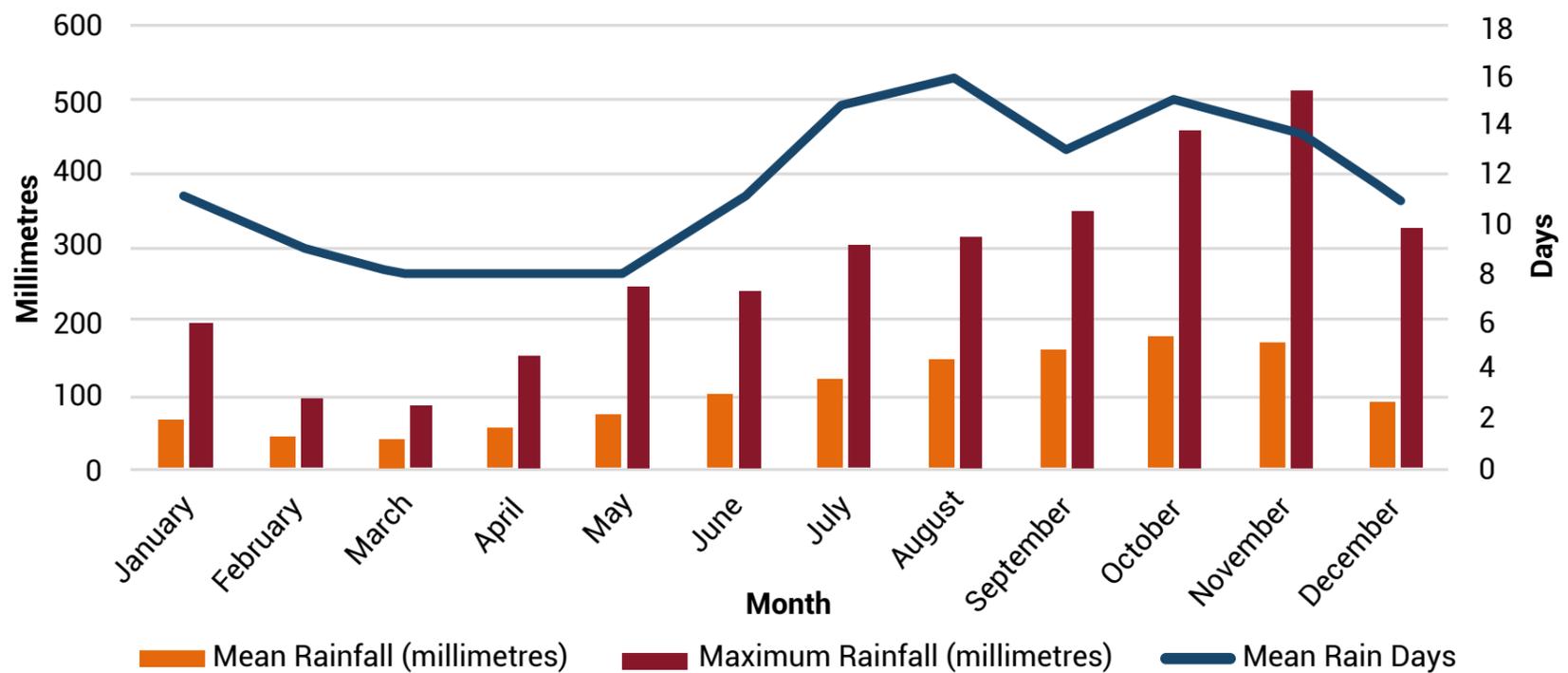
Droughts create increased financial burdens at the national and ultimately household levels. Such burdens are characterised as notable increases in basic commodity prices during drought periods. The 2009/2010 drought in the Caribbean resulted in significant losses for productive assets. As a result, commodity prices across the Caribbean region soared: vegetables (by 250 per cent per pound) and fruits (by between 40.7 to 60.8 pper cent) (Farrell et al., 2010).

Barbados is highly vulnerable to variable and unpredictable rainfall patterns (FAO, 2016). Data derived from the Barbados Meteorological Services highlights climatic conditions in Barbados. Figure

<sup>71</sup> Especially amongst those that exhibits a relatively high incidence of non-communicable diseases (such as hypertension, obesity, and diabetes) and renal impairments.

18 indicates the total annual rainfall recorded during 1991-2020<sup>72</sup>. With an arithmetic annual average of 1260mm, the time series data indicates that the driest months were January, February, March, April, and May - all of which fall within the designated dry season for Barbados<sup>73</sup>. Collectively, this resulted in an arithmetic average of 280.9mm over the 5-month period with the least mean rainfall occurring in March (38.9mm). In addition to this, the average rainfall was less than 75mm within this 5-month period.

**Figure 18: Total Rainfall Patterns in Barbados (1991-2020)**



Source: The Barbados Meteorological Office

From the month of June to November, the gradual rise in the two indices: (i) mean rainfall and (ii) maximum rainfall were correlated with an increasing intensity of hydrometeorological systems progressing across the Atlantic Ocean. The total maximum rainfall for the time series amounted to 3,292.8mm. During November, the highest level of maximum rainfall was recorded for any given (513.9mm) whereas the lowest level of maximum rainfall was experienced in March (87.2mm). Overall, the total days of rainfall days over the period 1991-2020 was 139 - with the highest and lowest frequencies occurring in August (16 days) and April/May (8 days each).

### Lithometeors

Dust emanating from the Sahara and Sahel regions of North Africa and the Gobi, Takla Makan, and Badain Jaran deserts of Asia represent the primary sources of mobilized desert top soils (Griffin, 2007). The Sahara desert represents the largest source of airborne dust on Earth. All year round, Sahara dust particles traverse thousands of kilometres across the Atlantic Ocean towards the Western Hemisphere. In large concentrations, it is regarded as a 'natural feeding source of minerals along the Western Atlantic coast, a protective shield from solar radiation and a mechanism for marine biogeochemical cycling' (Sakhamuri and Cummings, 2019). It is also highly responsible for the fertilization of nutrient-poor soils within the Amazon basin and the vibrant effects associated with spectacular sunsets across the Caribbean region during the passage of significant dust plumes. Besides minerals, dust plumes also transport hydrocarbons, allergens and microbial compounds from Africa. Within the Caribbean atmosphere, airborne microorganisms can

<sup>72</sup> The Barbados Meteorological Office. 2022. "Climate Data". <https://www.barbadosweather.org/>

<sup>73</sup> There is a distinct dry season from December to May and a wet season from June to November.

increase ten-fold (Sakhamuri and Cummings, 2019) during the passage of significant dust plumes.

Exposure to fine particulate matter is the fifth most common risk factor for death worldwide - accounting for 4.2 million deaths and 103.1 million disability adjusted life-years in 2015 (Sakhamuri and Cummings, 2019). Sahara dust plumes are associated with negative impacts on air quality and human health – particularly for the youth and those with pre-existing respiratory conditions. These impacts include reduced visibility which could compromise daily activities especially within the aviation industry. Human health concerns range from asthma and sinusitis with an increased risk of cancer and meningococcal meningitis. Within Barbados, the incidence of asthma increased 17-fold between 1975-1996 - a period noted by an increased influx of dust plumes (Griffin, 2007). More recently in 2022, there have been several instances of dust-haze forecasts for Barbados. Such conditions will be exacerbated within the context of the Covid-19 pandemic – particularly amongst those with persistent respiratory symptoms.

### Heatwaves

Extreme weather events pose detrimental impacts to biodiversity, food production and agricultural productivity, water availability and the overall health of humans and animals – particularly livestock<sup>74</sup>. In Barbados, the heatwave season occurs from May to October (BGIS, 2019) and the severity of these events has been increasing in recent years<sup>75</sup>. Heatwaves pose a significant threat to segments of the Barbadian population<sup>76</sup> – particularly amongst those that exhibit a relatively high incidence of non-communicable diseases such as hypertension, obesity, and diabetes. Therefore, persons with pre-existing vascular complications are more susceptible to the threat posed from such extremes<sup>77</sup>. In addition to this, pregnant women, breastfeeding mothers, children, and individuals who are physically active in outdoor environments are highly susceptible to risk<sup>78</sup>.

74 BGIS. 2021. "Protect Livestock during Extreme Heat Conditions". <https://gisbarbados.gov.bb/blog/protect-livestock-during-extreme-heat-conditions/>

75 There were recent reports of the incidences of heatwaves in the United Kingdom, Europe and Australia.

76 BGIS. 2019. "Health Ministry's Advice To 'Beat The Heat'". <https://gisbarbados.gov.bb/blog/health-ministrys-advice-to-beat-the-heat/>

77 Strokes was ranked as the number one cause of death in Barbados over the period 2010-2012 (Ministry of Health, 2015 – now known as the Ministry of Health and Wellness, Government of Barbados).

78 BGIS. 2019. "Chief Medical Officer's Advice On How To Avoid Heat Stress". <https://gisbarbados.gov.bb/blog/chief-medical-officers-advice-on-how-to-avoid-heat-stress/>

## 2.1.2 Geological Hazards

This section provides an overview of geological hazards in Barbados which includes seismogenic hazards (earthquakes, tsunamis, rockfalls), volcanogenic hazards (volcanoes) and shallow geohazards (landslides). Within the Caribbean Archipelago, a series of tectonic plates such as the Caribbean Plate, the South American Plate, the North American Plate, and the Atlantic Plate converge. Such geological interactions create an area of subduction (called the Lesser Antilles Subduction Zone) and are responsible for unique features and land formations along the Caribbean Archipelago. Barbados is subdivided into two main geological regions – a karst landscape comprised of deeply fractured and gullied limestone laid down in a series of terraces, deeply incised by numerous gullies and underlain by a complex underground cave system - which accounts for 86%. The remaining 24% is comprised of sedimentary deposits<sup>79</sup> within the north-eastern portion of the island - the Scotland District. This sub-region demarcates an area prone to a wide series of geological hazards.

The topography within this subregion is relatively steep in comparison to the remainder of the island. The highest point on the island is Mount Hillaby at 336m (1,104 ft). According to the United Nations Educational, Scientific and Cultural Organization (UNESCO)<sup>80</sup>, the Scotland District is exceptionally unique because it is the only location within the entire Caribbean Basin where a mountain range creates an accretionary prism above sea level. This occurs because the Scotland District acts as a subduction zone noting the convergence of two tectonic plates: The Atlantic Plate and the Caribbean Plate. This constant interaction resulted in sedimentary deposits on the ocean floor over an extensive period of time. Such deposits were later thrust upwards to create a thick wedge of oceanic sediments – a phenomenon mostly observed within underwater mountain ranges.

The region contains dense vegetation unlike the rest of the island that has been deforested and earmarked for different types of physical development in accordance with the island's development control

79 The Scotland district contains rocks about 30 to 50 million years old, namely clay stones, sand- and siltstones, volcanic ash layers, chalk, and radiolarite (chert or flint, when hardened), as well as some odd rock formations such as mineral concretions that resemble huge canon balls.

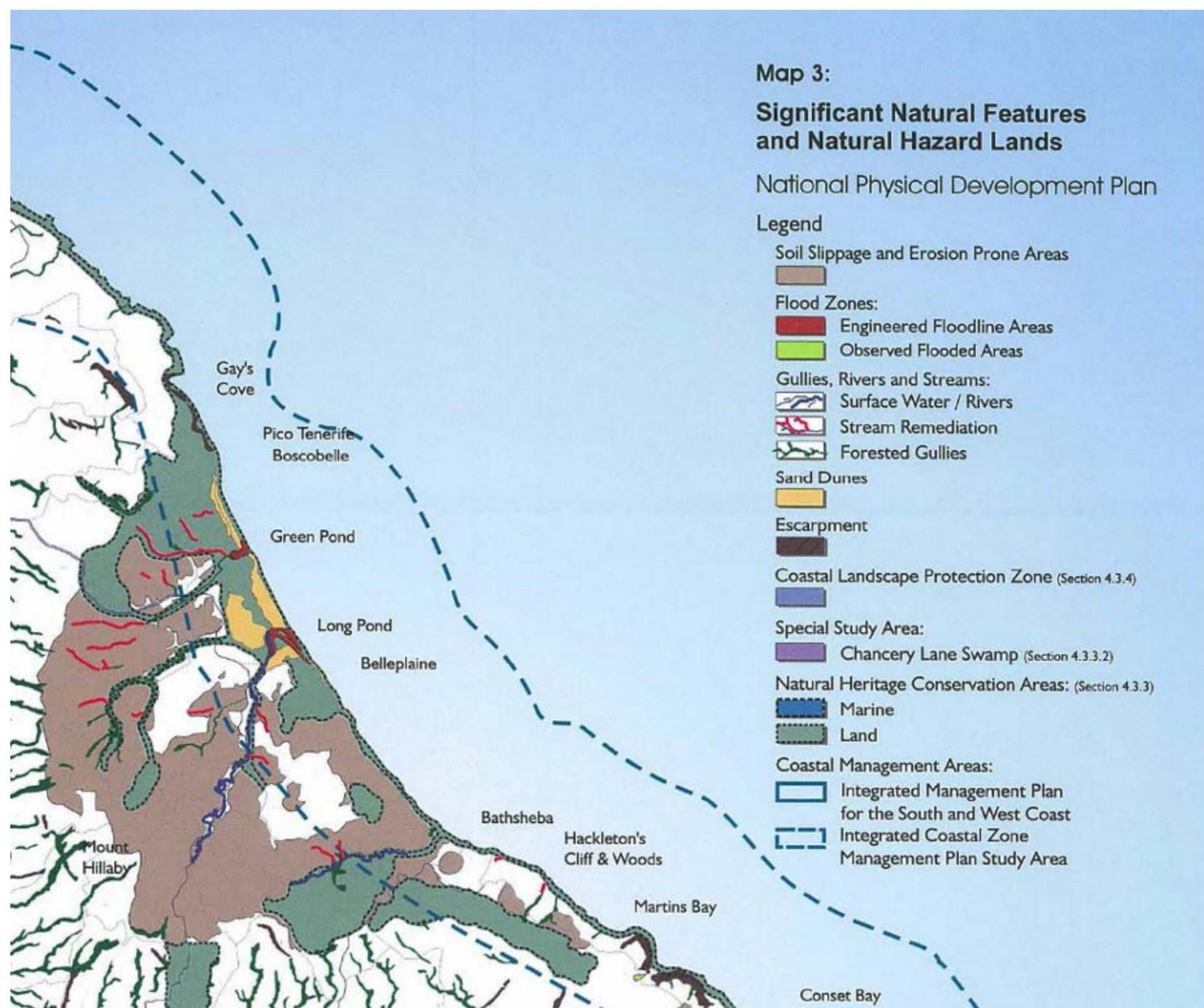
80 UNESCO. 1993. "The World Heritage Convention: Tentative Lists". <https://whc.unesco.org/en/tentativelists/1993/#:~:text=Coordinates%3A%20Barbados%20is%20located%20at,in%20its%20east%2Dcentral%20part.>

zones. According to the Barbados Statistical Service's 2000 Population Census estimates, the extent of the population residing in St. Andrew, St. Joseph and St. Thomas was 26,008 persons. When compared to other designated urban centres across Barbados, the Scotland District is relatively sparsely populated. The total amount of persons residing within the two parishes of St. Andrew and St. Joseph that are fully encapsulated by this sub-region was 11,759. This accounted for 0.04% of the total estimated population in 2010.

### Landslides

In Barbados, soil slippage and soil erosion are mostly prevalent within the Scotland district - an area classified as erosion prone by the Barbados Town and Country Planning Office. As a result, many small-scale landslides are associated with coastal escarpments where undercutting by wave action creates instability. This is due to the presence of slumps and extensive loose sediments derived from earth and debris – a direct consequence of the slope of the land and decreased porosity of the soils owing to its clay origins. Impacts such as fractures or breaks in water pipes (often triggered by land movement) in conjunction with extensive rainfall exacerbate the issue by trapping of water between the geological strata (DEM, 2014). A description of these hazards is seen in Figure 19.

Figure 19: Geological Hazards within the Scotland District



Source: The Barbados Physical Development Plan (amended 2003)

## Earthquakes

Significant tectonic and seismic activity as well as its associated effects are a mainstay of the Caribbean Archipelago. Unlike its neighbouring territories which are volcanic in nature and strategically located on the Lesser Antilles Subduction Zone, Barbados is regarded as an outlier. As a result, the Leeward Islands are characterised by 'higher seismicity than the Windwards for both short and long period components of ground motion' (DEM, 2014). Hazard maps outlining seismicity in the region to varying degrees<sup>81</sup> are prepared by the University of the West Indies' Seismic Research Centre (SRC)<sup>82</sup>. This is achieved by conducting a 'probabilistic seismic hazard analysis' spanning the majority of the Caribbean Archipelago<sup>83</sup> (Bozzonni et al., 2011). The direct effects associated with earthquakes include infrastructural damage; mass movement; fires; floods; liquefaction and tsunamis. An overview of this regional seismicity is observed in Appendix XII whereas Figure 20 provides a map of regional earthquake hazards to date.

Figure 20: Earthquake Hazards across the Eastern Caribbean



Source: The University of the West Indies: Seismic Research Centre, 2022

Even though Barbados is in close vicinity to the subduction zone between the Caribbean and North American plates, it has the 'lowest hazard for all components of ground motion due to its distance from intraplate seismicity' (DEM, 2014)<sup>84</sup>. Historically, this subduction zone which extends to depths of approximately 200km has generated earthquakes of magnitudes as high as 8.0. As a result, a large magnitude earthquake

81 Seismic hazard maps at a regional scale outline return periods of 95, 475 and 975 years with a representation of the peak ground acceleration. <https://uwiseismic.com/downloads/seismic-hazard-map/>

82 The University of the West Indies. 2022. "Seismic Research Centre". <https://uwiseismic.com/>

83 A probabilistic seismic hazard analysis has been performed in order to compute probabilistic seismic hazard maps for the Eastern Caribbean region (10-19°N, 59-64°W), which includes in the north the Leeward Islands (from Anguilla to Dominica) and in the south the Windward Islands (from Martinique to Grenada), Barbados and Trinidad and Tobago.

84 BGIS. 2014. "Earthquakes and Tsunamis No Stranger To Barbados". <https://gisbarbados.gov.bb/blog/earthquakes-and-tsunamis-no-stranger-to-barbados/>

felt along the Lesser Antilles' magmatic arc has the potential to generate hazards resulting in higher levels of damage impacts (direct, indirect, or secondary) and higher economic losses for Barbados.

Approximately 500 earthquakes are experienced within a sub-region classified as the Barbados seismic zone. On average, 13 geological hazards of this nature occur - with magnitudes greater than 2.5 (SRC, 2022). An area of dormancy is largely associated with the deepest section of the Barbados accretionary prism. However, the island has experienced its share of seismic activity, as seen in Appendix XII<sup>85</sup>. Characterized as a 7.7 magnitude event, seismic activity was experienced on March 19<sup>th</sup>, 1953, along the north-west coast of Saint Lucia. This event caused ripple effects in Barbados - leading to major infrastructural damage within its Central Commercial District, Bridgetown. Further up the island chain, a 7.3 magnitude earthquake was felt north of Martinique in 2007<sup>86</sup>. This also resulted in ripple events in Barbados but to a lesser extent than the 1953 geological hazard of this nature. On February 18<sup>th</sup>, 2013, a 6.3 magnitude earthquake was experienced more than 100 km north of Barbados. Similarly, a peculiar earthquake was experienced on July 16<sup>th</sup>, 2015, approximately 100 km north-east of Barbados - originating 200 km from the island arc. This geological hazard was associated with a foreshock of a magnitude 6.2, a main shock of magnitude 6.6 (approximately 4 hours later) and several aftershocks over an extensive period. On October 16<sup>th</sup>, 2021<sup>87</sup>, a 5.3 magnitude earthquake was felt 265.5 km (165 miles) southwest of Bridgetown. More recently, a 3.8 magnitude earthquake was felt on June 20<sup>th</sup>, 2022. This event occurred just off the south-eastern coast of the island of Barbados and originated from a depth of 40 km.

### Volcanoes

Barbados differs geologically from other territories within the Caribbean region by virtue of its evolution. Most countries are deemed as volcanic in nature whereas Barbados is comprised of pleistocene reef limestones that make up 86% of its landscape. Caribbean volcanoes have produced some of the most memorable eruptions the world has ever seen. In comparison to hurricanes, storms, and tsunamis,

volcanoes are the leading cause of death by geological forces. According to the University of the West Indies' Seismic Research Centre, Caribbean volcanoes were responsible for approximately 30,000 deaths in comparison to those resulting from hurricane (~15,000); earthquakes (~15,000) and tsunami-related events over the past 300 years. All documented volcanic hazards over this timeframe are seen in Appendix XIV. Considering this, volcanic eruptions therefore represent an active and persistent hazard to the Caribbean region as the Lesser Antilles is located within the magmatic arc - even though a few of these geological features are now considered as dormant or extinct. Barbados is generally considered as an outlier for this geological hazard because it is vicinity to the Lesser Antilles Subduction Zone; nevertheless, it has had a limited share of experiences with volcanic hazards.

Volcanic activity in the region is carefully monitored by the University of the West Indies' Seismic Research Centre<sup>88</sup>. This institution monitors 16 of the 21 active volcanoes in the Eastern Caribbean and manages the Montserrat Volcano Observatory, which monitors the Soufrière Hills Volcano in Montserrat. Likewise, the Institut de Physique du Globe de Paris (IPGP) monitors volcanic activity in Martinique and Guadeloupe (SRC, 2022). In the event of potential hazards, the National Emergency Management offices within the respective countries coordinate activities on the ground. Figure 21 shows a map of volcanic hazards across the Caribbean Region.

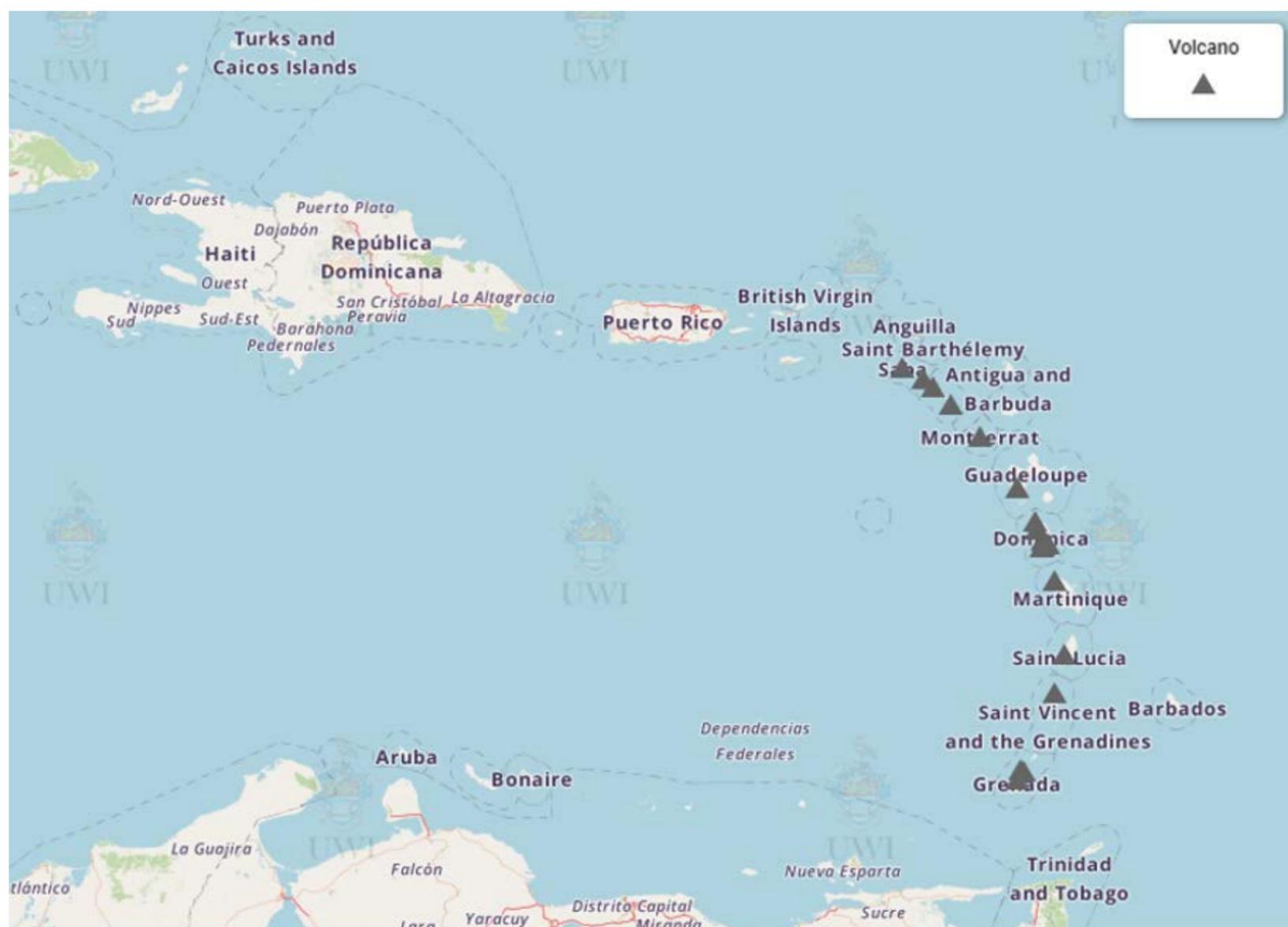
85 The University of the West Indies: Seismic Research Centre. 2022. "Interactive Map". <https://map.uwiseismic.com/index.php#%7B%22location%22:%22map%22,%22layers%22:%22EQ%22%7D>

86 The University of the West Indies: Seismic Research Centre. 2022. "Island Profile – Barbados". <https://uwiseismic.com/island-profiles/barbados/>

87 Loop News. 2021. "5.3 Magnitude Earthquake off Barbados felt in parts of Trinidad, Grenada". <https://barbados.loopnews.com/content/53-earthquake-barbados-felt-parts-trinidad-grenada>

88 The University of the West Indies: Seismic Research Centre. 2022. "Volcano Monitoring". <https://uwiseismic.com/volcanoes/volcano-monitoring/>

Figure 21: Volcanic Hazards across the Eastern Caribbean



Source: The University of the West Indies: Seismic Research Centre, 2022

Volcanic hazards for Barbados are largely associated with ashfall deposits and lightning strikes which pose devastating effects for many sectors<sup>89</sup> - particularly the health, transportation, agriculture, tourism, water, and environmental sectors. Wind currents around the globe – particularly Trade Winds proceed in a westerly direction. Noting such, the prevalence of ashfall deposits emanating from the Lesser Antilles towards Barbados is quite remarkable. Such a phenomena can occur if the volcanic eruption is very significant in terms of its explosivity and can propel pyroclastic material – a combination of ash, gas and rocks into the upper atmosphere creating an ash plume. This phenomenon was associated with the following documented ashfall events.

89 BGIS. 2021. "Volcanic Ash – Its Effects, Cleaning Methods & More". <https://gisbarbados.gov.bb/blog/volcanic-ash-its-effects-cleaning-methods-more/>

### St. Vincent and the Grenadines

The La Soufrière Volcano located within Saint Vincent and the Grenadines erupted on Good Friday – April 13<sup>th</sup>, 1979<sup>90</sup>. This eruption was preceded by a long period of quiescence which originally began in 1903 following the 1902 eruption that totally devastated the northern part of the island. This was subsequently followed by a short period of volcanic unrest in 1971. In 1979, this recent unrest resulted in an ash plume of rock, ash, and gas. This plume was 18 km high and veered towards Barbados – located 180 km away. Intensified effects were associated with La Soufrière's volcanic eruption on April 9<sup>th</sup>, 2021 when compared to the 1971 eruption – mimicking the explosivity of La Soufrière's 1902 eruption (SRC, 2022). This eruption was even visible from the NASA Space Station. Originally, a series of eruptions began in December 2020 and eventually culminated in a highly explosive event that warranted the evacuation of 20,000 people in St. Vincent and the Grenadines. For Barbados, this event resulted in extensive economic losses and damages<sup>91</sup> amounting to approximately USD \$43.55 million (BBD \$87.1 million) dollars. Owing to the severity of the hazard posed to the island and the proposed soil fertility benefits<sup>92</sup> to promote greater agricultural yields<sup>93</sup>, the GoB embarked upon a National Ash Collection Drive which was halted in July 2021<sup>94</sup>.

### Montserrat

After previously lying dormant for hundreds of years<sup>95</sup>, the Soufrière Hills volcano located on the British Overseas Territory of Montserrat erupted on July 18<sup>th</sup>, 1995 (Hincks et al., 2021). Prior to 1995, the last eruption of Soufrière Hills took place approximately 300 years ago (Shepherd et al., 1971; Young et al., 1996; Shepherd et al., 2003; Hincks et al., 2021) with small eruptions of dense andesite, forming the Castle Peak lava dome in English's Crater (Young et al., 1996; Hincks et al., 2021). This stratovolcano lies on the southern part of the island. Eruptions began during July 1995 following three years of elevated seismicity characterized by phreatic activity (Robertson et al., 2000; Hincks et al., 2021). This was succeeded by a dome extrusion in November which catalysed the start of magmatic activity (Kokelar, 2002; Hincks et al., 2021). The eruptions were classified into three (3) phases of seismicity (as seen in Figure 22) and five (5) phases of lava dome intrusions<sup>96</sup>. The latter phases were noted by distinct geological features, land formations and dome destructions. As a result of the ongoing volcanic activity, the Government of Montserrat ordered the evacuation of most its citizens living within the exclusion zone. This led to the mass emigration of the island's inhabitants to neighbouring Caribbean territories like Barbados and to the United Kingdom.

Figure 22: Phases of Seismicity for the Soufrière Hills volcano



Source: Hincks et al., 2021

90 Barbados Today. 2021. "La Soufrière's Good Friday 1979 eruption marked by explosion". [https://barbadostoday.bb/2021/04/14/la-soufrieres-good-friday-1979-eruption-marked-by-explosion/?fbclid=IwAR2jKdEXQwFMF\\_z29Ue\\_rGNjcU05b-a9ty1mZnVX6SGY-5JQyk70sHUpat9Y](https://barbadostoday.bb/2021/04/14/la-soufrieres-good-friday-1979-eruption-marked-by-explosion/?fbclid=IwAR2jKdEXQwFMF_z29Ue_rGNjcU05b-a9ty1mZnVX6SGY-5JQyk70sHUpat9Y)

91 BGIS. 2021. "Minister Caddle: \$87 Million Ashfall Impact". <https://gisbarbados.gov.bb/blog/minister-caddle-87-million-ashfall-impact/>

92 BGIS. 2021. "FAQs on the effects of Ash Fall on Crop Production". <https://gisbarbados.gov.bb/blog/faqs-on-effects-of-ash-fall-on-crop-production/>

93 BGIS. 2022. "Survey on Impact of Volcanic Ash on Farmers". <https://gisbarbados.gov.bb/blog/survey-on-impact-of-volcanic-ash-on-farmers/>

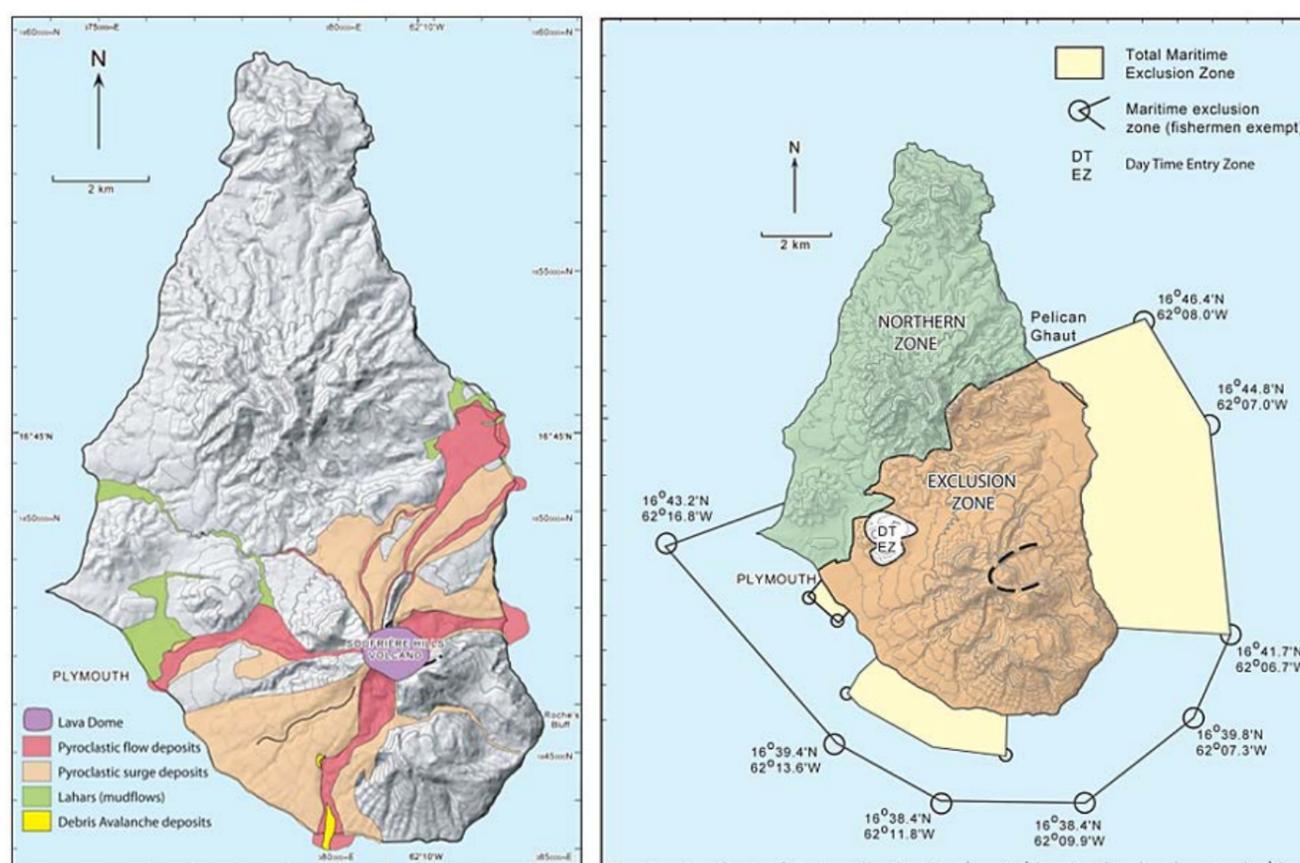
94 BGIS. 2021. "Environment Ministry: No More Ash Collection". <https://gisbarbados.gov.bb/blog/environment-ministry-no-more-ash-collection/>

95 Hincks et al. 2021. "Volcanic Hazards Atlas of the Lesser Antilles". <https://uwiseismic.com/wp-content/uploads/2021/10/Montserrat.pdf>. There was no historical record of eruptions on the island prior to 1995.

96 There have been five phases of lava dome extrusion: November 1995 – March 1998; November 1999 – July 2003; August 2005 – April 2007; July 2008 – January 2009 and October 2009 – February 2010 (Wadge et al., 2014).

As seen in Figure 23, the nature of the volcanic hazards posed were pyroclastic flows, volcanic blasts, explosions, tephra fall and mudflows. The dome-forming character of the eruption is a major factor in determining the level of hazard across the island, as the rate and direction of extrusion are subject to (often rapid) fluctuations. The explosions resulted in the expulsion of an ash plume which posed severe visibility and health challenges in Barbados for several months following its initial and subsequent eruptions.

**Figure 23: Map of Montserrat showing volcanic risks and hazards for the Soufrière Hills Volcano**



Source: Hincks et al., 2021

Note: Right Hand Side: Volcanic risk map for the Soufrière Hills Volcano, 1st August 2004

Left Hand Side: Volcanic deposits/hazard map for the Soufrière Hills Volcano

### Grenada

Kick-'em-Jenny is the only active submarine volcano located within the Caribbean Archipelago. Located approximately 197 km below sea level and 8 km north of Grenada (12.18°N, 61.38°W), the volcano stands 1300m high with a summit 300m wide (SRC, 2022). In contrast to other Caribbean volcanoes located above sea level, Kick-'em-Jenny is 'the most active volcano in the Eastern Caribbean having erupted at least 14 times since 1939' (SRC, 2022)<sup>97</sup>. There are two distinct natures of its eruptive style: phreatomagmatic explosive eruptions and effusive dome eruptions. As a result, hazard impacts associated with this volcano include ballistic projectiles, lowered water intensity, the Tragedy of the Island Queen<sup>98</sup> and tsunamis. In addition to this, the volcano's proclivity for edifice instability has the potential to generate submarine landslides and tsunami related effects such as volcanic earthquakes and submarine volcanoes<sup>99</sup>. According to a renowned geologist,<sup>100</sup> 'Kick-'em-Jenny does not pose a direct threat to Barbados' (BGIS, 2018)<sup>101</sup>; however, this geological feature is carefully monitored by the University of the West Indies: Seismic Research Centre and the GoB' Department of Emergency because the island is susceptible to tsunami risk.

97 The University of the West Indies: Seismic Research Centre. 2022 "Volcanoes – Kick-'em-Jenny". <https://uwiseismic.com/volcanoes/kick-em-jenny/>

98 One of Grenada's worst maritime tragedies may have resulted from just this phenomenon. On the 5th August 1944, the wooden schooner Island Queen, with over 60 people on board, disappeared between Grenada and St. Vincent. At the time it was thought that a German or allied submarine had torpedoed the boat. These theories, however, cannot easily explain the total lack of debris after the boat's disappearance. However, if a boat sinks because of lowered water density everything would sink. Kick-'em-Jenny had, in fact erupted the year before (1943) and it is highly likely that it was still actively degassing in 1944, without any signs at the sea surface of such activity.

99 The University of the West Indies: Seismic Research Centre. 2022. "Volcanoes: Kick-'em-Jenny Hazards". <https://uwiseismic.com/volcanoes/kick-em-jenny/kej-hazards/>

100 BGIS. 2018. "Kick-'Em-Jenny No Direct Threat To Barbados". <https://gisbarbados.gov.bb/blog/kick-em-jenny-no-direct-threat-to-barbados/>

101 BGIS. 2017. "DEM Monitoring Kick-'em-Jenny". <https://www.nationnews.com/2017/05/01/dem-monitoring-kick-em-jenny-activity/>

## Tsunamis

The Eastern Caribbean represents a zone of significant tectonic plate interactions thereby increasing the prevalence of tsunamis resulting from geological hazards such as earthquakes, volcanoes and landslides. According to the University of the West Indies: Seismic Research Centre, there were 'ten confirmed earthquake-generated tsunamis'<sup>102</sup> over the last 500 years (SRC, 2022). Figure 24 shows a map of intra-regional tsunami hazards. Tsunami hazards generated intra-regionally are associated with the least number of deaths when compared to other geological hazards in the last 300 years. Extra-regionally, tsunami hazards in the vicinity to the Mid-Atlantic Ridge and beyond also have the potential to cause significant threats owing to the geological nature of land formations – particularly Iceland, the Azores and the Cape Verde islands. Factors that directly contribute to the intensity of a tsunami include distance, strength, speed and time.

**Figure 24: Tsunami Hazards across the Eastern Caribbean**



Source: The University of the West Indies: Seismic Research Centre. 2022

The topography of Barbados and its close vicinity to the Lesser Antilles Subduction Zone places it at increased risk from tsunami hazards. As seen in Table 6, the island has been impacted by at least four (4) tsunamis within the 17<sup>th</sup> and 19<sup>th</sup> centuries.

**Table 6: Tsunami Impacts in Barbados**

Year	Depth of Tsunami (metres)	Nature of the Geological Force	Origin
1755	2	Earthquake	Lisbon Earthquake resulted in the generation of a tsunami that travelled from Portugal across the Atlantic Ocean. As a result, extensive wave swells were recorded in Barbados and Martinique
1762	...	Earthquake	The Azores earthquake near Portugal.
1902	2-3	Volcano	The La Soufrière Volcano located within Saint Vincent and the Grenadine
1939	2	Volcano	The Kick-'em-Jenny submarine volcano off the coast of Grenada.

Source: The University of the West Indies: Seismic Research Centre. 2022

102 The University of the West Indies: Seismic Research Centre. 2022. "Caribbean Tsunamis". <https://uwiseismic.com/tsunamis/caribbean-tsunamis/> The University of the West Indies: Seismic Research Centre. 2022. "Island Profiles – Barbados". <https://uwiseismic.com/island-profiles/barbados/>

On the global scale, tsunami hazards are monitored by the UNESCO Intergovernmental Oceanographic Commission (IOC)<sup>103</sup>. A regional arm of the IOC is the Intergovernmental Coordination Group for the Tsunami and other Coastal Hazards Warning System for the Caribbean and Adjacent Regions (ICG/CARIBE-EWS). This entity coordinates multi-national and multi-agency initiatives to mitigate the threat posed from tsunami hazards across the Caribbean archipelago. In its efforts, the ICG/CARIBE-EWS is supported by research and technical expertise derived from the University of the West Indies: Seismic Research Centre which monitors tsunami activity across the region<sup>104</sup>. Since 2011, the ICG/CARIBE-EWS has developed a tsunami preparedness calendar and conducted a regional tsunami exercise called CARIBE WAVE<sup>105</sup> on an annual basis.

### Rockfalls

Barbados is exceptionally unique because of its evolutionary origins. It is one of the few landmasses within the Caribbean Archipelago that is mostly comprised of sedimentary rocks. As seen in Figure 25, the landscape is riddled with extensive cave and gully systems – the perimeter of which is affected by constant wave action. Seismic activity can also intensify the associated effects of cave-ins. Over time, the stability of the topsoil may be severely compromised and result in the destruction of cliff faces<sup>106</sup> and family tragedies<sup>107</sup>. The latter refers to the 'Arch Cot Incident of August 2007' in Brittons Hill, St. Michael<sup>108</sup>.

**Figure 25: Rockfall Impacts in Barbados**



Source: [www.barbados.org](http://www.barbados.org); Nation News Barbados

Note: (Left Hand Side) The Arch Cot Site in Brittons Hills where an apartment block collapsed;  
(Right Hand Side) The collapsed cliff face at Foul Bay, St. Philip.

103 UNESCO Intergovernmental Oceanographic Commission. 2022. <https://www.ctic.ioc-unesco.org/>.

104 The University of the West Indies: Seismic Research Centre. 2022. "Tsunami Monitoring". <https://uwiseismic.com/tsunamis/tsunami-monitoring/>

105 UNESCO Intergovernmental Oceanographic Commission. 2022. "CARIBE WAVE/CARIBE WAVE LANTEX Exercises". <https://www.ctic.ioc-unesco.org/caribe-wave-caribe-wave-lantex-exercises>

106 [www.barbados.org](http://www.barbados.org); <https://barbados.org/bcfoulbay.htm>

107 BGIS. 2014. "After Arch Cot". <https://www.nationnews.com/2014/08/31/after-arch-cot/>

108 BGIS. 2018. "Brittons Hill: 10 Years After The Arch Cot Cave-in". <https://www.youtube.com/watch?v=B6CIEwfaqyM>

To minimise the occurrence of death from this type of hazard, geotechnical studies<sup>109</sup> have now been warranted following an application for proposed development (either residential or commercial) to the Barbados Town and Country Planning Office. Such geotechnical studies would therefore inform engineers of the potential risks of construction – by “providing valuable information on the load bearing capacity of the soil of the proposed development to be undertaken”(BGIS, 2018).

### 2.1.3 Environmental Hazards

This section outlines the environmental hazards posed to Barbados. Such hazards are largely associated with natural processes and anthropogenic activities that affect health and livelihoods. These include land and soil degradation, biodiversity loss, deforestation, air pollution, wildfires, sea level rise, coastal and soil erosion, coral bleaching and eutrophication. Climate change poses a serious and existential threat to Small Island Developing States, impacting the standard of living, level of commerce and the characteristics of biomes. The IPCC predictions for the Caribbean region include:

- Increased average atmospheric temperatures
- Increased precipitation
- Reduction in average annual rainfall
- Increased sea surface temperatures
- Increased intensity of tropical cyclone

#### Land Degradation, Deforestation and Biodiversity Loss

Barbados has a small natural resource endowment and factors that contribute to land degradation include deforestation, land use changes, soil erosion and the mineral extractive industries. The first European settlers arrived in Barbados in 1627 and found most of the island covered with forests; however, within 30 years approximately 80% of the forested area was cleared (Watt, 1966). Land use changes attributable to extensive mono crop agriculture as well as planned and unplanned urban and suburban developments. Such developments associated with socio-economic activities like tourism as well as residential and commercial properties all contribute to declines in the extent of biodiversity and highly productive agricultural lands.

109 BGIS. 2018. 'Guiding Development in Arch Cot, St. Michael'. <https://gisbarbados.gov.bb/blog/guiding-development-in-arch-cot-st-michael/>

#### Soil Degradation and Soil Erosion

Soil erosion is most prevalent within the Scotland District and can directly contribute greater surface runoff and flash flooding in instances of extensive rainfall. Unsustainable farming and agricultural practices that involve the use of herbicides also degrade the mineral content of the soils. Mineral extractive industries such as cement plants and quarry mining for limestone also exacerbate the issue.

#### Air Pollution

Even though greenhouse gas emissions for Barbados are considered negligible on the global scale, the increase in vehicular traffic<sup>110</sup> and industrialized processes on the island threatens the health and productivity of the citizens as more pollutants are emitted into the atmosphere. The GoB, in its quest to transition the island to a 100 per cent reliance on renewable sources of energy by 2030<sup>111</sup>, has embarked upon several efforts to promote this ideology. During the first quarter of 2022, electric vehicles accounted for 27 per cent of total imports whereas hybrid models accounted for 73 per cent (Barbados Today, 2022). Following the budgetary presentation in March 2022, the Prime Minister of Barbados announced that effective August 1, 2022 there will an Excise Tax and Value Added Tax holiday for the purchase of electric vehicles and reduced import duties for used electric vehicles to 10 per cent. These incentives are expected to transition the existing fleet of vehicles to more energy efficient models thereby increasing the ratio of electric and hybrid vehicles imported.

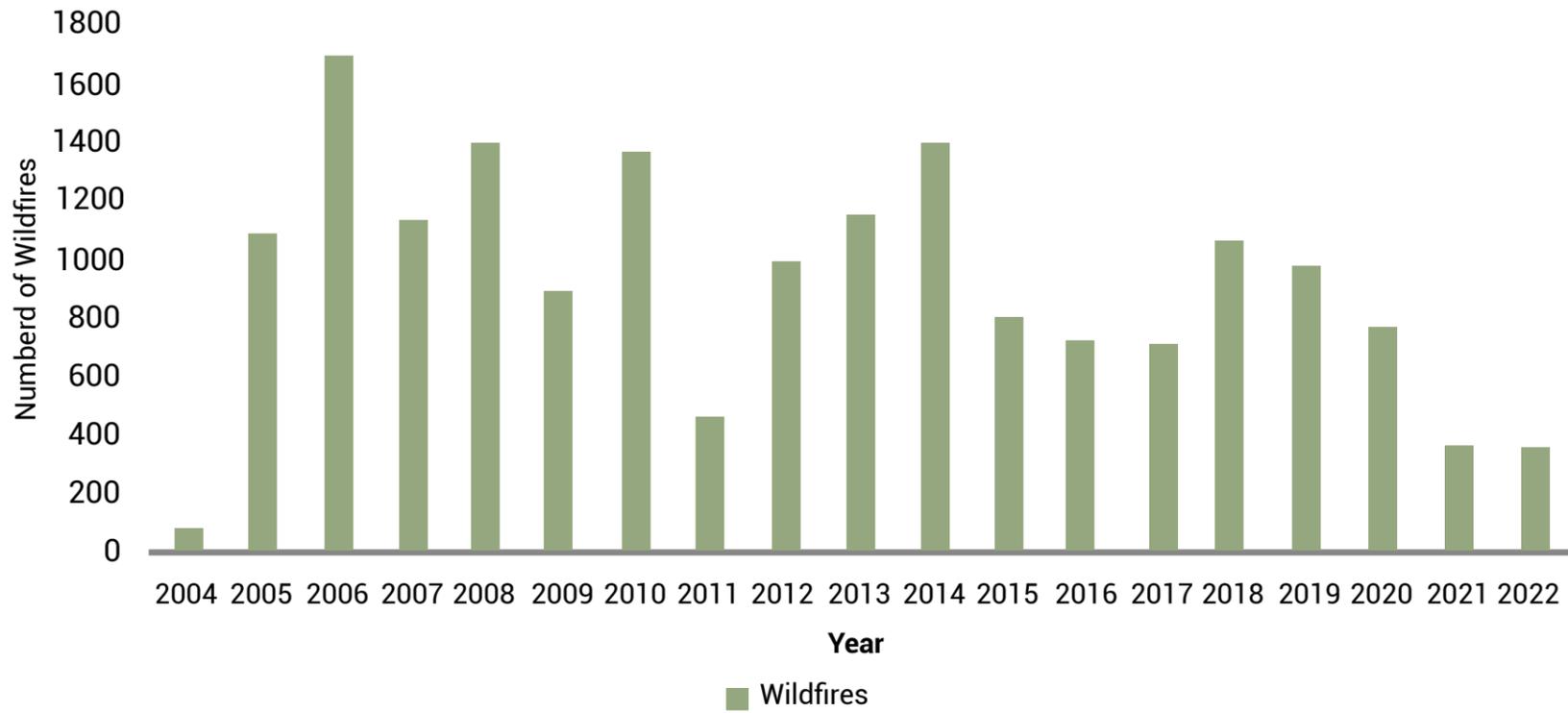
110 According to the Barbados National Assessment Report, 2010, (p.10), it was estimated that there were approximately 116,675 vehicles on the road; 81% of which are private cars. In October 2022, it was estimated that there were 131,000 registered vehicles on the island by the Barbados Licensing Authority.

111 Barbados Today. 2022. "Hybrids in demand; electric vehicle sales growing slowly". <https://barbadostoday.bb/2022/08/05/hybrids-in-demand-electric-vehicle-sales-growing-slowly/>

### Wildfires

Wildfires are typically prevalent during the dry season which spans from December to June. They pose respiratory risk to humans, result in crop and property damage and place increasing strains on the island's limited water resources<sup>112</sup>. However, some wildfires are deemed as intentional via archaic methods of clearing land, discarding rubbish, and eradicating pests or invasive species. As seen in Figure 26, the incidence of wildfires has been documented by the Barbados Fire Service.

**Figure 26: The Incidence of Wildfires (2004-2022)**



Source: The Barbados Fire Service

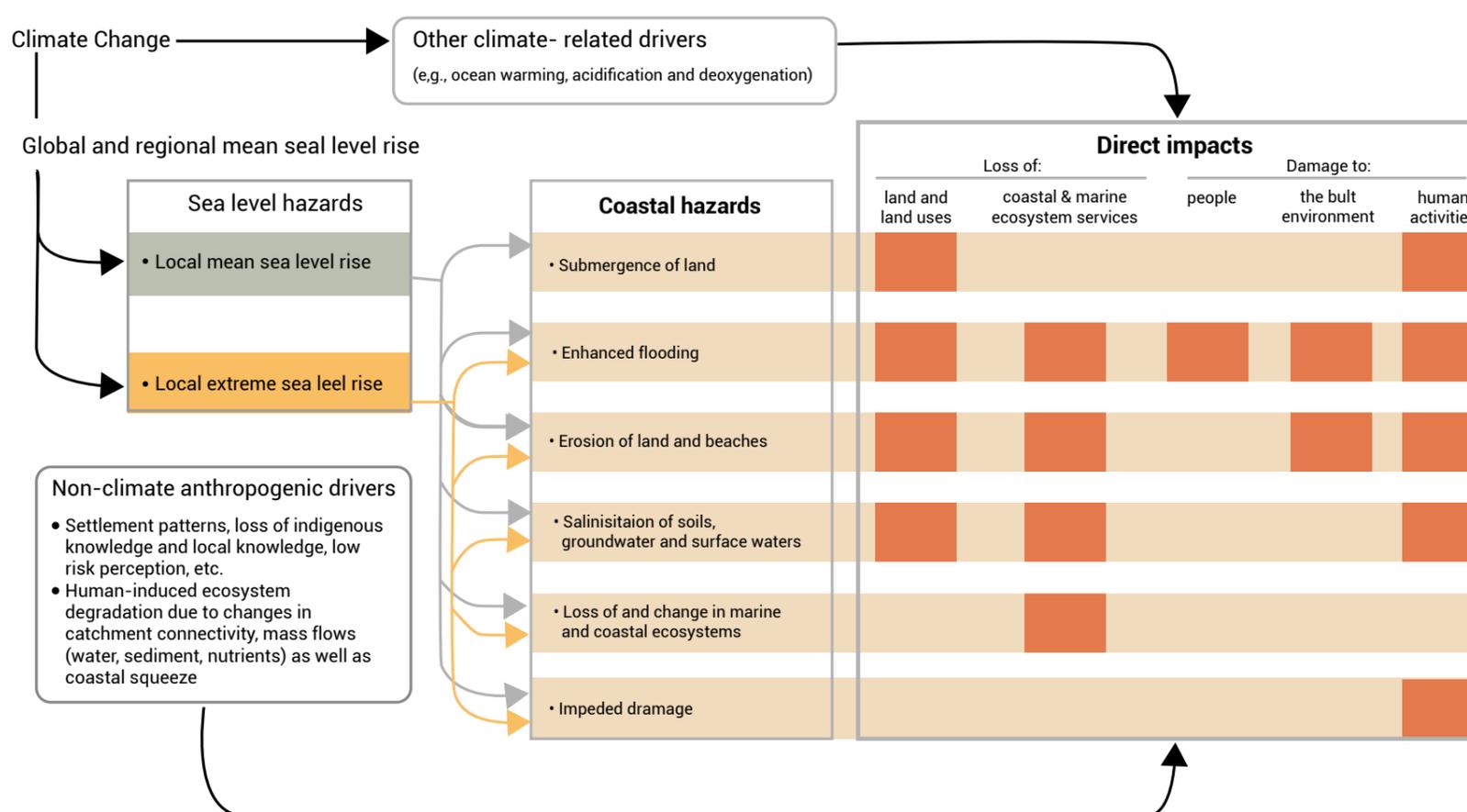
112 BGIS. 2020. "Fighting Fires With Reduced Water Use." <https://gisbarbados.gov.bb/blog/fighting-fires-with-reduced-water-use/>

## Sea Level Rise

According to the 2019 edition of the IPCC Special Report on Oceans and the Cryosphere, there is a 'high confidence that as the sea level continues to rise, the frequency, severity and duration of hazards and related impacts increases (Woodruff et al., 2013; Lilai et al., 2016; Vitousek et al., 2017; IPCC, 2019). In addition to this, detectable impacts and attributable impacts on shoreline behaviour are expected as soon as the second half of the 21st century (Nicholls and Cazenave, 2010; Storlazzi et al., 2018). There are six main concerns for a low-lying country like Barbados as depicted in Figure 27:

- Permanent submergence of land by mean sea levels and mean tide levels;
- More frequent or intense flooding;
- Enhanced erosion of land and coastlines;
- Loss and alteration of ecosystems;
- Salinisation of soils, ground and surface waters; and
- Impeded drainage

Figure 27: An overview of cascading effects of Sea Level Rise



Source: IPCC Special Report on Oceans and the Cryosphere, 2019

## Coastal Erosion

Most of the settlement across Barbados are located within 2 kilometres of the coastline. Such resources and infrastructure are highly susceptible to a range of coastal hazards that are intensified by climate-related drivers and non-climate anthropogenic drivers.

### Ocean Acidification and Human Based Activities

According to the IPCC, ocean acidification has increased globally as well as the frequency and intensity of marine heatwaves in some areas of the Indian, Atlantic and Pacific Oceans except for

a decrease over the eastern Pacific Ocean<sup>113</sup>. Most economic activities in Barbados are concentrated along the coastline. Non-climate drivers such as settlement patterns and human induced ecosystem degradation can severely compromised the quality and quantity of ecosystem services conducted within the marine biome. Human based activities in Barbados include recreation, coastal tourism, coastal fisheries, and shoreline management.

113 IPCC. 2022. "IPCC Sixth Assessment Report: Working Group I – The Physical Science Basis: Regional Fact Sheet - Small Islands

### Shoreline Management: Coastal Defence Systems and Land Use Policies

This involves the development of strategic, long term and sustainable coastal defences and land-use policies within a sediment cell. The island has natural and man-made coastal defence systems. These include mangrove swamps and coastal barriers along the southern and western coasts of the island. Examples of coastal barriers include the Richard Haynes Boardwalk in Christ Church (as seen in Figure 28) and the Folkestone Park and Marine Reserve Boardwalk in St. James.

Figure 28: Coastal Defence Systems - The Richard Haynes Boardwalk



Source: Author

There has been a series of current and planned shoreline developments. Such initiatives seek to promote shoreline stabilization and erosion control along the western and southern corridors – low-lying regions that are prone to extensive flooding. Such developments are concentrated within the island’s tourism belt and includes marinas such as Port St. Charles and Port Ferdinand in St. Peter and a proposed redevelopment in St. Lawrence Gap, Christ Church<sup>114</sup>.

#### Coral Bleaching

Intensified hydrometeorological systems, storm surges, coral bleaching and eutrophication such as algae blooms are all attributable to rising sea surface temperatures. Deemed as fuel for hydrometeorological systems, sea surface temperatures are directly correlated to coastal impacts such as storm surges. According to the IPCC, ‘Small Islands will face more intense but generally fewer tropical cyclones, except in the central north Pacific where frequency will increase (medium confidence at a global warming level of 2°C and above)’<sup>115</sup>. Hence, the greater the temperature, the

greater the magnitude of the coastal impacts. Coral bleaching can severely comprise food chain and food web dynamics as well as the extrinsic value of coral reefs in a tourism-dependent economy like Barbados.

#### Eutrophication

Eutrophication can decrease near shore visibility and lead to a degradation in the quality of coastlines and beaches. For instance, sargassum seaweed is a major environmental hazard affecting marine environments and tourism establishments across the Caribbean Archipelago. Addressing this issue will therefore require an unprecedented level of cooperation among CARICOM Member States<sup>116</sup>. Barbados is demarcated into a series of water protection zones that limit the extent of physical development to varying degrees (see Section 1.3.7). The threat posed by groundwater contamination is the relatively high. This threat is not only attributable to saltwater intrusion, but also illegal squatting, illegal dumping and chemical contamination arising from commercial and agricultural practices (see Section 2.2.3).

114 BGIS. 2022. “MP apologises to Residents”. <https://www.nationnews.com/2022/10/01/mp-apologises-residents/>

115 IPCC. 2022. “IPCC Sixth Assessment Report: Working Group I – The Physical Science Basis: Regional Fact Sheet - Small Islands”.

116 Barbados Government Information Service. 2019. “Sargassum Seaweed A Threat To Caribbean Economies”. <https://gisbarbados.gov.bb/blog/sargassum-seaweed-a-threat-to-caribbean-economies/>

## 2.1.4 Chemical Hazards

This sub-section outlines the chemical hazards posed to Barbados. These include oil spills and other hazardous chemicals. The presence of oil spills within various biomes particularly the marine environment can severely compromise the quantity and quality of ecosystem services conducted. As a result, oil spills pose deleterious effects on food chains and food webs and lead to the disruption of blue economy related activities. Table 7 provides an overview of oil spills over a particular timeframe. There have also been a few instances of spontaneous combustion at the largest recycling facility<sup>117</sup> on the island. This has resulted in the release of noxious gases which pose a health hazard to neighbouring communities. Concerted efforts have been made to monitor the quantity of recycled material at the facility that originated from the landfill<sup>118</sup>.

**Table 7: The Incidence of Petrochemicals spills (2009-2014)**

Date	Product	Quantity/bbl	Location	Parish
01 January 2009	Oil	3	Bridgetown Port, Inc.	St. Michael
06 May 2009	Hydrocarbons (Possible Diesel, Gasoline, Kerosene)	unknown	Warrens	St. Michael
28 April 2009	Oil	19	Holborn	St. Michael
21 October 2010	Diesel	5	Oistins Bay	At Sea
Jan 27 2011	Used Oil	unknown	Jackson Terrace	St. Michael
Feb 9 2011	Diesel	unknown	Porters	St. James
Feb 22 2011	Used Oil	unknown	Wildey	St. Michael
28 February 2011	Used Oil	unknown	Spring Garden	St. Michael
Oct 14 2011	Diesel	42	Spring Garden	St. Michael
May 29 2013	Oil	<1	Little Bentley	St. George
Jul 23 2013	Oil Emulsion	unknown	Checker Hall	St. Lucy
17 July 2013	Used Oil	unknown	St. Matthias	St. Michael
17 July 2013	Oil Emulsion	1.5	Pine	St. Michael
23 May 2014	Tar	unknown	Gemswick	St. Michael
26 August 2014	Oil	2.15	Jemmott's Lane	St. Michael

Source: Environmental Protection Department; DEM, 2014

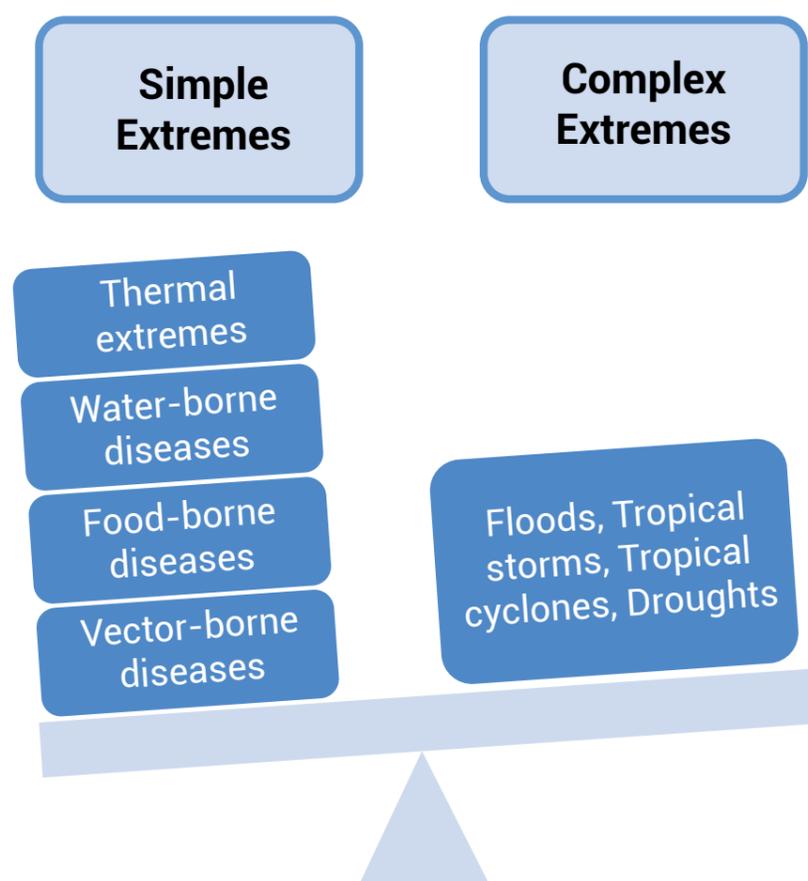
117 NationNews. 2019. "Update: Fire at Recycling Plant". <https://www.nationnews.com/2019/08/13/update-fire-at-recycling-business/>

118 BGIS, 2021. "Significant Progress Made At B's Recycling Plant". <https://gisbarbados.gov.bb/blog/significant-progress-made-at-bs-recycling-plant/>

## 2.1.5 Biological Hazards

This sub-section outlines the biological hazards posed to Barbados. From a regional perspective, average annual temperatures in the Caribbean Archipelago have increased by more than 0.5°C approaching 1°C over the last 100 years. The health impacts of climate change can be classified into two categories: (i) simple extremes of climatic statistical ranges that can be attributed to natural climate variability and (ii) complex extremes that can be attributed to droughts, floods or hydrometeorological events (as seen in Figure 29).

**Figure 29: Categories of Health Impacts associated with Climate Change**



Source: Author Adaptation

Thermal extremes posed to the regional community include heat waves - the incidence of which has been increasing in recent years<sup>119</sup>. The prevalence of water-borne diseases arising from the stagnation and contaminated of water supplies tends to peak during period of extensive rainfall. Diarrhoeal diseases such as cholera, cryptosporidium, E. coli infections, giardia, shigella, dysentery and viruses can occur. High incidences of cholera were noted during the aftermath of Haiti earthquake, whereas

instances of dysentery posed significant challenges to the Barbadian health sector after the passage of Hurricane Janet in 1955. There is a direct correlation between contamination of water supplies and the contamination of food sources<sup>120</sup>. In addition to this, the proliferation of rodents during and after hazardous events can give rise to food-borne diseases such as leptospirosis, salmonellosis, typhoid fever, tularaemia, and viral haemorrhagic diseases. Typhoid fever also posed a significant challenge to the Barbadian health sector after the passage of Hurricane Janet in 1955.

Rising temperatures, changing rainfall patterns and precipitation can increase the rate of vector-borne and waterborne diseases such as malaria, dengue fever that already exist in tropical small island states; however, this can be exacerbated by poor public health practices, inadequate infrastructure, and poor waste management practices. Vector reproduction, parasite maturation, and bite frequency will mostly increase with temperature; as a result, malaria, tick-borne encephalitis, and dengue fever will become prevalent (Akpinar-Elci & Sealy, 2014).

Table 8 highlights confirmed cases of Dengue Fever in Barbados over the period 2007-2014<sup>121</sup>. There were 1,137 reported cases of dengue in 2013, with the highest incidences in the urban parish of St. Michael. According to the 2016 Barbados Economic and Social Report<sup>122</sup>, there were 587 confirmed cases of dengue when compared to 122 in the previous year and 490 cases in 2014. The prevalence of Chikungunya, which was first recorded in Barbados in 2014, is on the rise. By the end of 2016, there were four confirmed cases and 123 suspected cases when compared to four confirmed cases and 63 suspected cases in the previous year with the highest incidence of infection being concentrated in the parish of St. Michael. Similarly, there were 711 suspected and 112 confirmed cases of Zika virus.

<sup>119</sup> There were recent reports of the incidences of heatwaves in the United Kingdom, Europe and Australia.

<sup>120</sup> The data for environmental health in Barbados is very sporadic. The periods identified were noted in 2012 Annual Report of the Ministry of Health – now known as the Ministry of Health and Wellness, Government of Barbados.

<sup>121</sup> Government of Barbados. 2015. "Barbados National Report for the Third United Nations Conference on Housing and Sustainable Urban Development: HABITAT III". <https://habitat3.org/wp-content/uploads/Habitat-III-Report-Barbados-final.pdf>

<sup>122</sup> This report was compiled by the Research & Planning Unit, Ministry of Finance and Economic Affairs, Government of Barbados (May 2017)

**Table 8: Cases of Dengue (2009-2014) and Chikungunya (2014) by Parish**

	Dengue Cases						Chikungunya Cases
	2009	2010	2011	2012	2013	2014	2014
Chist Churtch	9	61	43	76	231	61	17
St. Andrew	4	12	6	7	21	12	0
St. George	8	47	16	25	98	35	3
St. James	3	36	14	28	71	45	12
St. John	1	12	3	14	21	7	4
St. Joseph	3	11	4	6	18	14	2
St. Lucy	0	12	7	10	27	14	4
St. Michael	25	149	60	156	362	194	70
St. Peter	5	31	5	11	22	23	6
St. Philip	6	61	9	28	101	32	6
St. Thomas	1	19	6	16	40	16	9
Unknown	26	119	32	53	125	37	1
<b>TOTAL</b>	<b>91</b>	<b>570</b>	<b>205</b>	<b>430</b>	<b>1137</b>	<b>490</b>	<b>134</b>

Source: Excerpt of the GoB. 2015. "Barbados National Report for the Third United Nations Conference on Housing and Sustainable Urban Development: HABITAT III.", p.54

Health impacts associated with complex climatic extremes such as floods, tropical storms, tropical cyclones, droughts will simply amplify the prevalence of simple extremes that are largely attributed to the El Niño phenomena. This will therefore largely influence the total number of persons affected by climate change. In recent times, the GoB has reaffirmed its commitment to provide comprehensive health care to all Barbadians at a price which the country can afford. This coupled with public education campaigns seeks to promote awareness within the various social strata.

On the international scale, the COVID-19 pandemic has caused devastating impacts to the standard of living and level of commerce within the developed and the developing world. Barbados recorded its first two confirmed cases of COVID-19 on the 17th of March, 2020 – both imported cases from

the United States of America. In light of such, the country embarked on a quick, highly coordinated and comprehensive response during March 2020 to avert future risks<sup>123</sup>. The nature of this response as well as the presence of legislation coordinating bodies and facilities to address national crises<sup>124</sup> are undoubtedly key factors in the country's success to date in preventing widespread community transmission (PAHO/WHO, 2020; DEM, 2017) (Refer to Section 7 for additional details on COVID-19 in Barbados).

<sup>123</sup> Pan-American Health Organization. 2021. "Barbados – An example of government leadership and regional cooperation in containing the COVID-19 virus". <https://www.paho.org/en/documents/barbados-example-government-leadership-and-regional-cooperation-containing-covid-19-virus>

<sup>124</sup> DEM, 2019, DEM, 2017

## 2.1.6 Technological Hazards

This sub-section outlines the technological hazards posed to Barbados.

### Contaminations

On the regional scale, the BP oil spill in the Gulf of Mexico on April 10th 2010 resulted in the death of many marine species within the Caribbean Basin and comprised the complex ecological dynamics within various food chains and food webs<sup>125</sup>. Similarly, the Caribbean was threatened by 1.3 million barrels of crude oil from sinking oil tanker in October 2020. This potential oil spill caused by the sinking of the FSO Nabarima oil tanker in the Gulf of Paria<sup>126</sup> posed major implications to the economic development of neighbouring countries like Trinidad and Venezuela as well as the wider Caribbean region – particularly as it relates to the blue economy.

On the national level, the sewage crisis on the south coast of the island represented a major setback for tourism because raw sewage was flowing along the streets in Worthing and Hastings, Christ Church – in the heart of one of the island's main tourism hubs. As a result, several tourists were reluctant to travel to Barbados due the gravity of the situation on the island.

### Structural failure

Instances of structural failure across Barbados are evident within the island's sewage and transportation systems and road networks.

### Sewage Systems

In November 2017, the South Coast Sewage system along the island's major tourism belt failed as a result of breakdowns and blockages within its sewer system. Investigations revealed that the collector pipe delivering sewage to the treatment plant and the forcemain connecting the plant to the marine outfall had failed at several locations (CDB, 2019). This crisis caused significant distress for residents, business owners and visitors to the area because of the stench which persisted for almost two years. This national crisis<sup>127</sup> over-emphasized the extent

to which lives and livelihoods were correlated to the island's tourism product, cast a negative light on Barbados' reputation as a tourist destination and highlighted the importance of maintenance, verification and reporting of public infrastructure.

### Transportation Systems

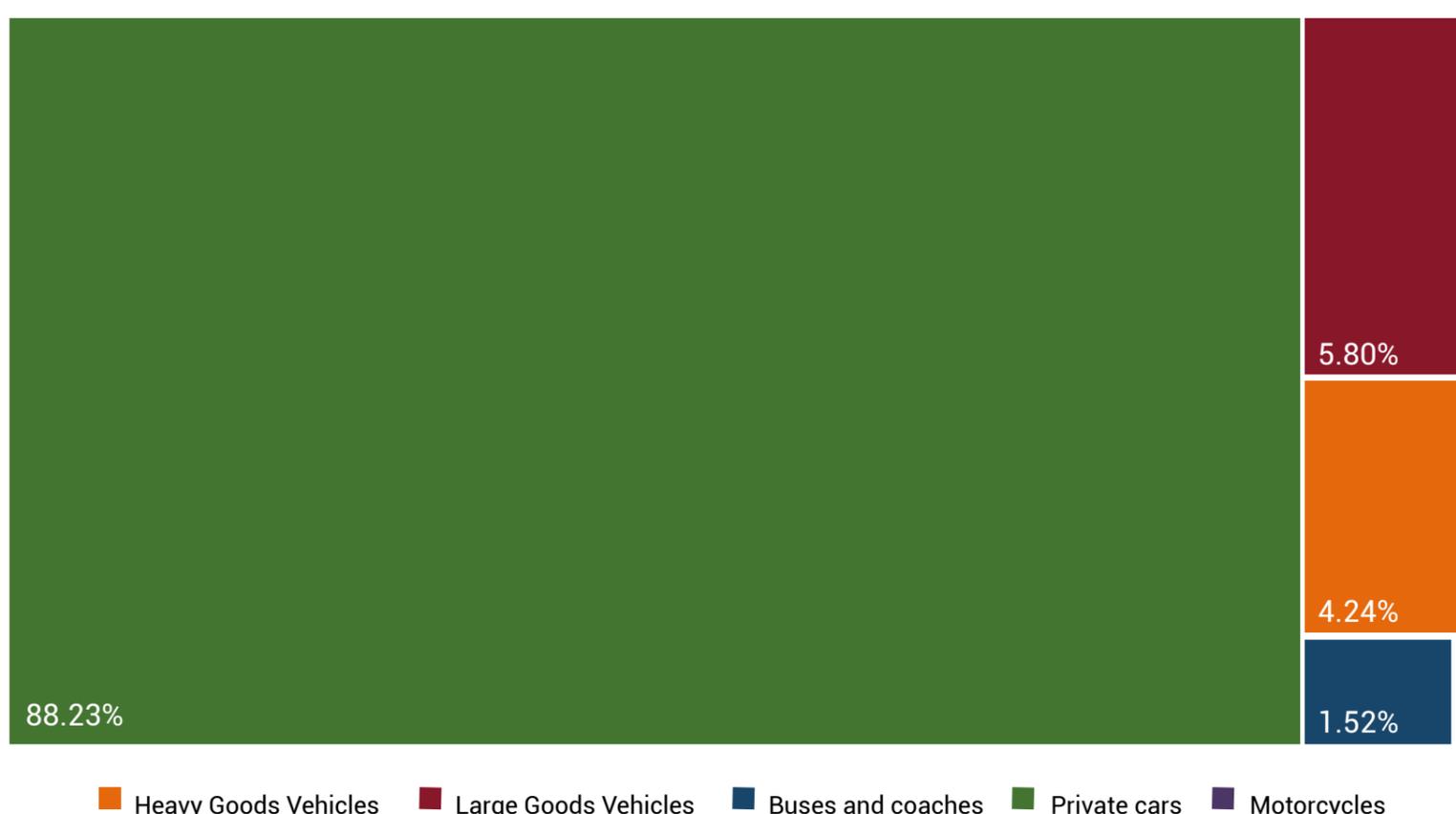
High levels of traffic congestion throughout the island's Central Commercial Districts have been attributed to the significant increase in the number of motor vehicles on the roads in recent decades. Over the period 1999-2009, the number of vehicles on the road has grown at a compounded annual growth rate of 6.8%. At that time, this growth rate well surpassed the acceptable international standards of 2.5% as a sustainable growth rate (Moore et al., 2014). As of November 2022, the total number of vehicles on the island was estimated at 156,000 – approximately half of the estimated total population in 2021 (Ministry of Economic Affairs, 2022). There is a predominately aged vehicular fleet on the island with approximately 70% of vehicles being 20 years or older including Heavy Goods Vehicles and Large Goods Vehicles (Ministry of Economic Affairs, 2022). Vehicular statistics disaggregated by type can be seen in Figure 30.

125 National Geographic. 2010. "Ten years later, BP oil spill continues to harm wildlife—especially dolphins". <https://www.nationalgeographic.com/animals/article/how-is-wildlife-doing-now--ten-years-after-the-deepwater-horizon>

126 CARICOM Today. 2020. "Potential Oil Spill Threatens Caribbean Sea". <https://today.caricom.org/2020/10/20/potential-oil-spill-threatens-caribbean-sea/>

127 BGIS. 2018. "South Coast Sewage Issue Deemed A National Crisis". <https://gisbarbados.gov.bb/blog/south-coast-sewage-issue-deemed-a-national-crisis/>

**Figure 30: Vehicular Statistics disaggregated by Type, 2021**



Source: Ministry of Economic Affairs, 2022

Hazard impacts associated with the transportation sector can be disaggregated into economic, social and environmental dimensions, as seen in Table 9. With 95% of the public transportation currently carbonized, several strides have been made facilitate the greening of the sector<sup>128</sup>. Prior to 2006, there have been no new editions to the existing public bus fleet. In 2019, there was an acquisition of electric and diesel powered buses with wheelchair facilities for the disabled to circumvent the aging bus fleet within the Barbados Transport Board – the public transportation entity. This was achieved through the exploration into an Electric bus fleet of 120-180 buses which commenced with a pilot study of an estimated 20 buses. In 2020, the first batch of 35 electric buses arrived on island<sup>129</sup>.

**Table 9: The Impacts of the Transport Sector on Sustainability**

Economic	Social	Environment
Traffic congestion	Inequity of impacts	Air and water pollution
Mobility barriers	Mobility disadvantaged	Habitat loss
Accident damage	Human health impacts	Hydrologic impacts
Facility costs	Community interaction	Depletion of non-renewable resources
Consumer costs	Community liveability	
National fuel costs	Aesthetics	

Source: Moore et al., 2014

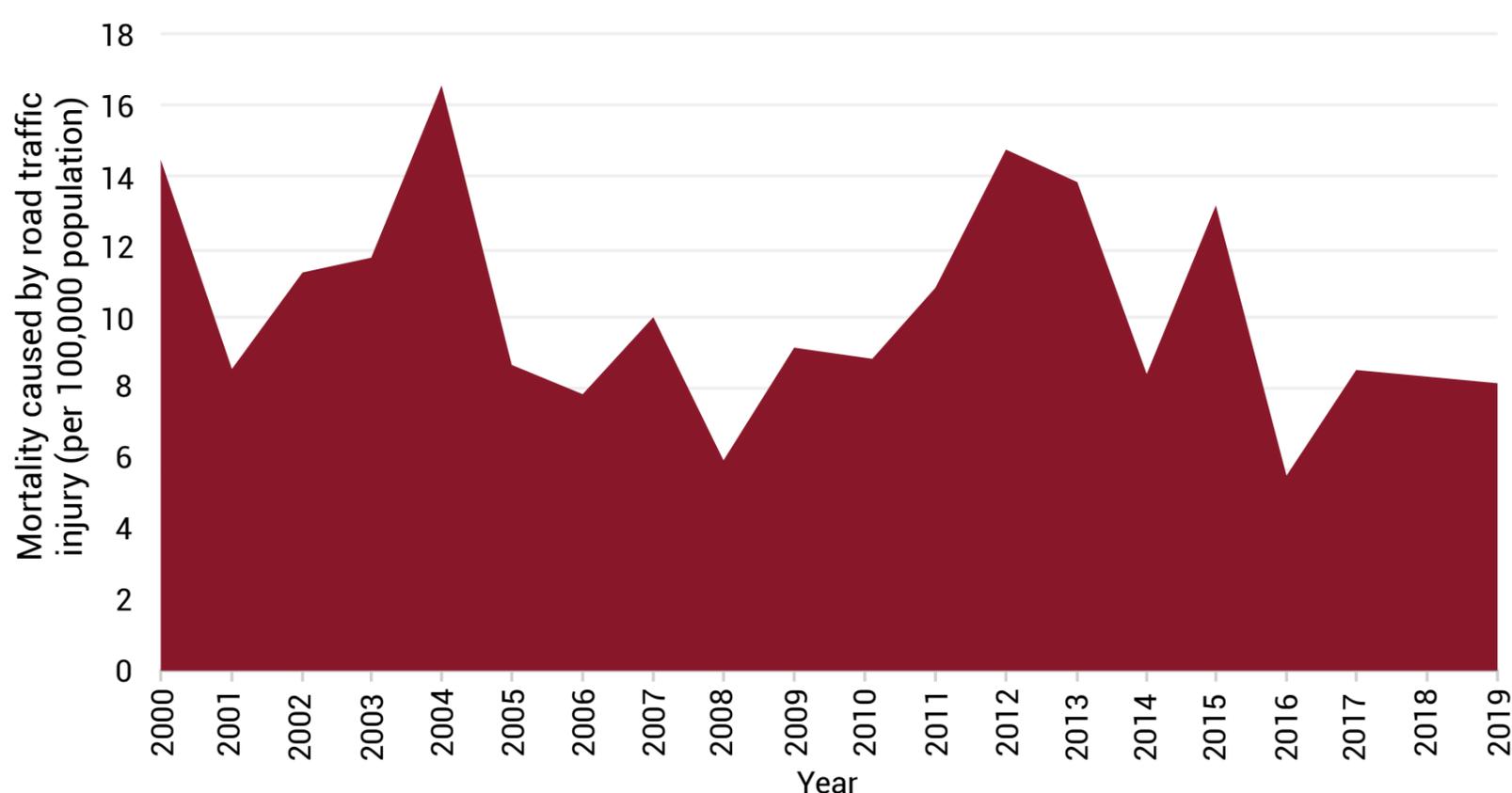
128 MOVE - Movilidad Eléctrica en Latinoamérica. 2021. "Electric buses implementation in Barbados". <https://www.youtube.com/watch?v=VFXG8Odfq-Y>

129 Barbados Today. 2021. "Transport Board says electric buses worth it". <https://barbadostoday.bb/2021/12/30/transport-board-says-electric-buses-worth-it/>

### Road Networks

The incidence of mortality resulting from road traffic injury over the period 2000-2019 is observed in Figure 31. On average, mortality resulting from road traffic injury accounts for 10.3 per 100,000 of the Barbadian population. The highest incidence of mortality from road traffic injury was noted in 2004 and accounted for 16.7 per 100,000 population. In contrast, the lowest incidence of mortality from road traffic injury was noted in 2016 which accounted for 5.6 per 100,000 population. Noting such, there have been several calls for the improvement of the island's road infrastructure (via the Ministry of Transport, Public Works and Water Resources Road Rehabilitation and Improving Connectivity of Road Infrastructure project) and to promote greater awareness of road traffic regulations.

Figure 31: The incidence of Mortality resulting from Road Traffic Injury per 100,000 Population by Year



Source: World Development Indicators

### Infrastructure Failure

Instances of infrastructural failure across Barbados are evident within the island's public services such as sanitation and utilities.

### Sanitation

The volume of solid waste generated within a highly densely populated island like Barbados poses grave challenges to national disposal efforts. The public entity responsible for sanitation services on the island is the Sanitation Service Authority. In recent times, this entity has been riddled with challenges stemming from a lack of personnel, a paucity of vehicles and the existence of adhoc collection schedules to ensure the efficiency and effectiveness of this public service. To address these challenges, efforts have been made to promote better sanitation practices amongst the populace - particularly as it relates to recycling. For instance during 2021,

households and businesses were issued with new garbage cans with recycle receptors to separate waste upon disposal<sup>130</sup>. In addition to this, the acquisition of new sanitation service vehicles<sup>131</sup> and other equipment were added to the aging fleet. These new vehicles have increased capacities to collect the increasing volumes of waste as well as recycle receptors to separate waste upon collection.

### Public Utilities

Infrastructural failures across public utilities poses many challenges to the productivity, resource security as well as the health and safety of the

<sup>130</sup> Barbados Today. 2021. "New garbage collection, recycling system rolls out". <https://barbadostoday.bb/2021/09/30/new-garbage-collection-recycling-system-rolls-out/>

<sup>131</sup> BGIS. 2019. "10 New Garbage Trucks As Promised". <https://gisbarbados.gov.bb/blog/10-new-garbage-trucks-as-promised/>

Barbadian populace. Owing to its economies of scale, the island of Barbados has a sole water supplier – the Barbados Water Authority. Within this entity, there is extensive bureaucratic red tape to get issues rectified (for instance breaks in water main and water outages) and a lack of coordination in maintenance efforts with other public utilities across the island. This generally leads to long delays and road disruptions along major transportation networks and significant water losses as a result of prolonged leakages. Similarly, the Barbados Light and Power Company Limited acts as the sole utility company on the island responsible for power generation. This reality poses severe challenges to maintaining the island's energy security because the current infrastructure is highly sensitive and hence susceptible to faults not only under 'business-as-usual' scenarios but also during extreme weather events.

### Water supply failure

Due to the age of BWA's infrastructure<sup>132</sup>, the frequency of water main breaks and water outages have increased. This situation becomes exacerbated in extreme weather events, when not only the water quantity but also the quality of the resource is highly susceptible to saltwater intrusion.

### Radio and Telecommunications Failure

Barbados has a sophisticated information technology infrastructure. However, the extent of its centralization across the public sector and the private sector poses a major national security threat when faced with exogenous shocks – especially over prolonged periods. There was a major telecommunications disruption across Barbados and six other Caribbean nations on December 8<sup>th</sup>, 2020<sup>133</sup>. This rare internet blackout occurred because of a fault in the region's mainline connection to the internet. This triggered outages and bothersome delays on mobile and broadband internet services and hampered examination procedures on all the University of West Indies campuses around the region (Barbados Today, 2020). Similarly, there is an increasing incidence of cyber-attacks<sup>134</sup> and ransomware<sup>135</sup> within the GoB' Information

Technology Platform that hampers the productivity of ministries and departments – particularly in the areas of national security and health<sup>136</sup>. The existence of ransomware also compromises the ability of these agencies to adequately address and thereby fulfil the needs of the general populace.

### Power Outage

The Barbados Light and Power has requested several rate increases in the past few years deeming that the industry is not highly profitably noting the subsequent oil price shocks on the international market. The high sensitivity of its electrical equipment has resulted in community-wide or island wide blackouts. This was the exceptional case during the passage of Hurricane Elsa in September 2021 as the entire population was without electricity for almost 10 days<sup>137</sup>. As a result of such, there have been national awareness campaigns to sensitize the public on alternative energy sources and emergency preparedness.

### Fire

The incidence of fires in Barbados has been documented within Barbados Fire Service Annual reports that are submitted to the Barbados Parliament. According to its 2016 Annual Report, there 1,787 fires reported in 2016 compared to 2000 fires in 2012; 2157 fires in 2013; 2652 in 2014; and 1908 in 2015 (as seen in Figure 32). Generally speaking, the incidence of fire is on the decline and this emphasizes that the Barbadian populace heeds advice on fire safety and fire-related public awareness campaigns.

132 The majority of water mains are located underground and are almost 100 years old. In recent times, the mains been steadily replaced via infrastructural projects with various donor agencies.

133 Barbados Today. 2020. "Rare internet outage strikes Barbados, Eastern Caribbean". <https://barbadostoday.bb/2020/12/08/rare-internet-outage-strikes-barbados-eastern-caribbean/>

134 NationNews. 2022. "Disruption of services continue at QEH". <https://www.nationnews.com/2022/12/15/disruption-services-continue-qeh/>

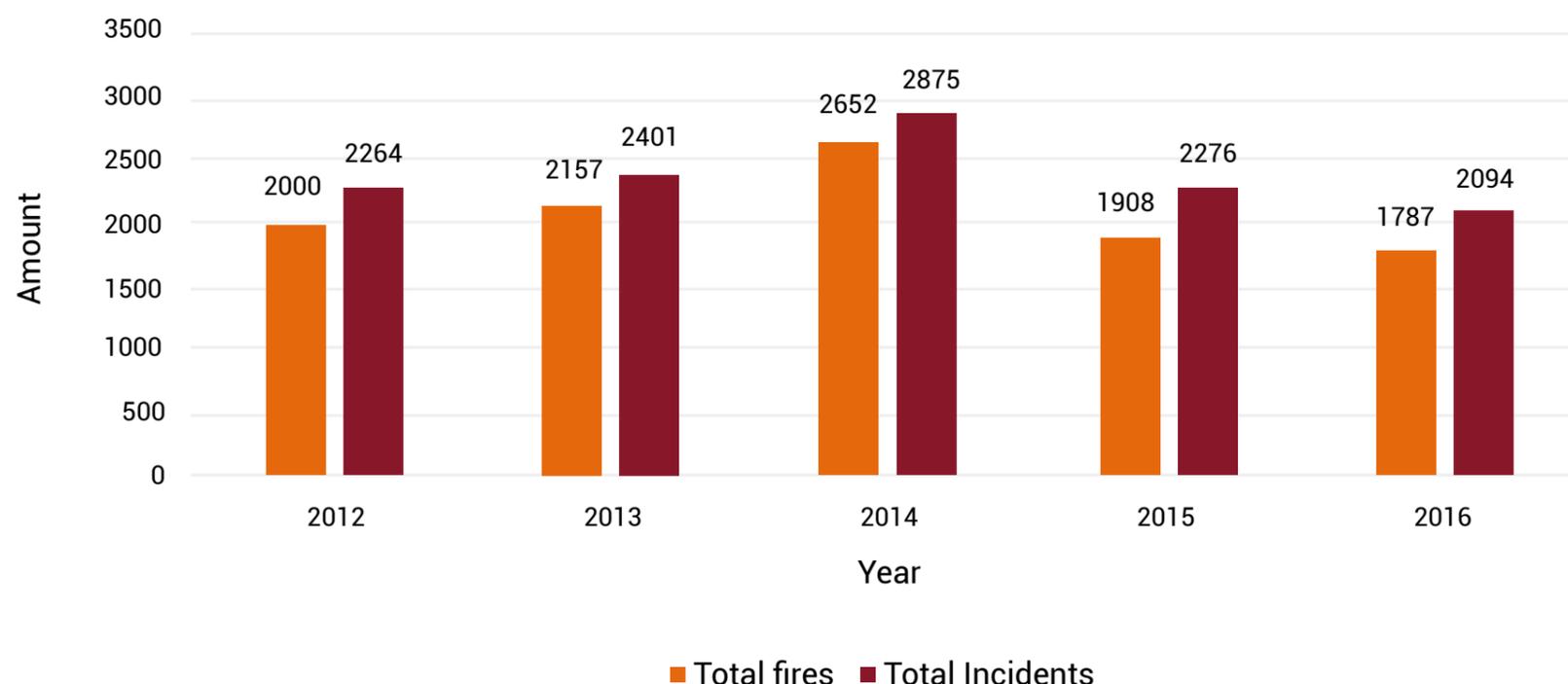
135 NationNews. 2022. "Government boosting IT system after breach". <https://www.nationnews.com/2022/03/11/government-boosting-system-breach/>

[boosting-system-breach/](https://www.nationnews.com/2022/12/14/qeh-changes-due-internet-issues/?fbclid=IwAR0-RoQNYLny-DG2CSQKe9PwgeN0P0-bclSFHUQpR62KZU_6V8Vvs_q0xEE)

136 NationNews. 2022. "Possible delays at QEH due to internet issues". [https://www.nationnews.com/2022/12/14/qeh-changes-due-internet-issues/?fbclid=IwAR0-RoQNYLny-DG2CSQKe9PwgeN0P0-bclSFHUQpR62KZU\\_6V8Vvs\\_q0xEE](https://www.nationnews.com/2022/12/14/qeh-changes-due-internet-issues/?fbclid=IwAR0-RoQNYLny-DG2CSQKe9PwgeN0P0-bclSFHUQpR62KZU_6V8Vvs_q0xEE)

137 BGIS. 2021. "Barbados Light & Power's Restoration Efforts Continue". <https://gisbarbados.gov.bb/blog/barbados-light-powers-restoration-efforts-continue/>

**Figure 32: The Incidence of Fires**



Source: The Barbados Fire Service

### 2.1.7 Societal Hazards

This sub-section outlines the societal hazards posed to Barbados.

#### Crime

Crime continues to be of growing concern at the individual and state levels in Barbados. According to the United Nations Office on Drugs and Crime, Barbados is regarded as one of the safest countries in the world noting its high degree of political stability and absence of corruption, rule of law, and control of corruption. However, the country is currently plagued by a series of austerity measures and rising unemployment coupled with the onset of the COVID-19 Pandemic<sup>138</sup>. This has caused a recent surge in crime rates – particularly gun-related crimes<sup>139</sup>. Estimates derived from the 2022 edition of the United Nations Office on Drugs and Crime Report highlight the trends for the homicide rate (as seen in Figure 33) and other criminal offences in recent times<sup>140</sup>, (as seen in Figures 34 and 35

respectively. There has also been a heightened national awareness of child<sup>141</sup> abuse, sexual abuse and elder abuse<sup>142</sup> which has prompted calls to revise existing legislation<sup>143</sup>. The lower crime rates in 2020 have been attributed to the strict lockdown measures imposed to manage the COVID-19 pandemic, but since the relaxation of these measures, there is concern of an impending increase in the coming years.

138 However, there have been no major instances of civil unrest, armed conflict, or stampedes.

139 BGIS. 2022. "Attorney General Addresses Recent Increase in Gun Crimes". <https://gisbarbados.gov.bb/blog/attorney-general-addresses-recent-increase-in-gun-crimes/>

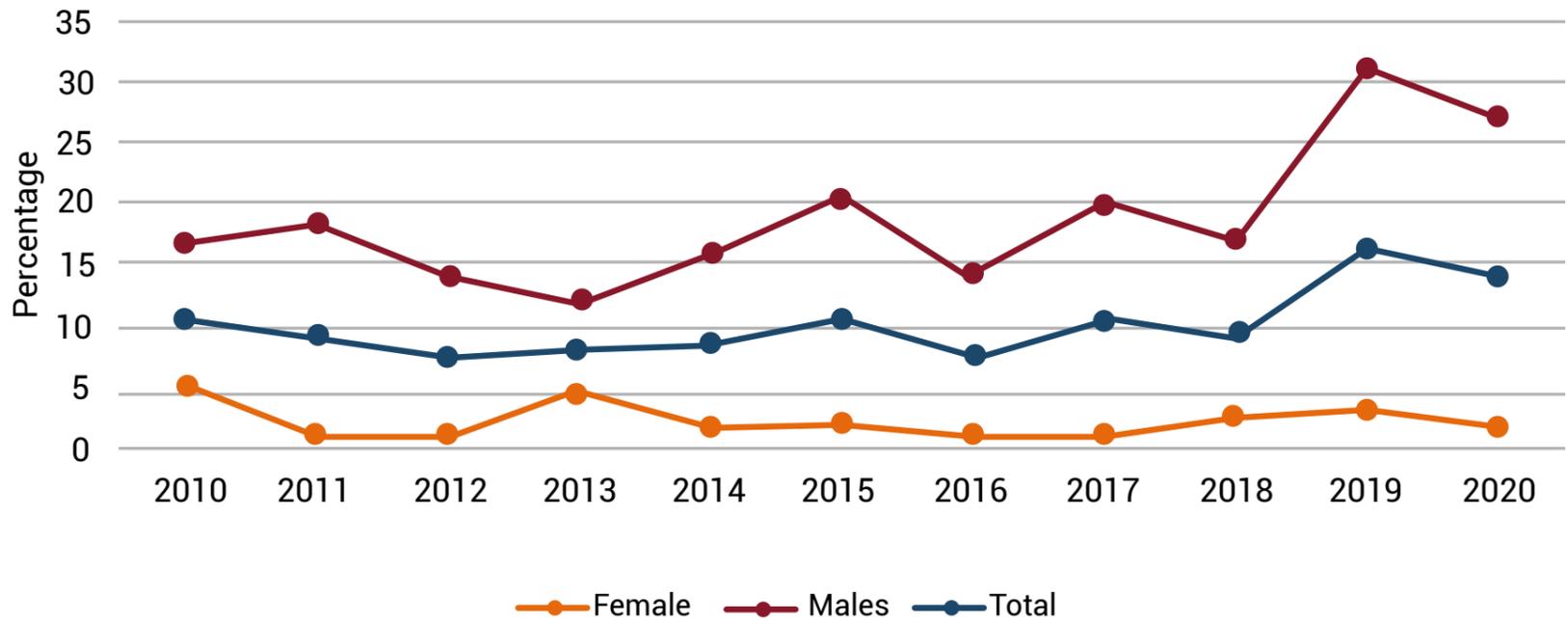
140 UNODC. 2022. "Country Profile: Barbados". <https://dataunodc.un.org/content/country-list>

141 Barbados Today. 2022. "CCB concerned Bajans not speaking up about child abuse" <https://barbadostoday.bb/2022/04/02/ccb-concerned-bajans-not-speaking-up-about-child-abuse/>

142 Barbados Today. 2021. "Griffith: Elder abuse a big problem in Barbados". <https://barbadostoday.bb/2021/06/15/griffith-elder-abuse-a-big-problem-in-barbados/>

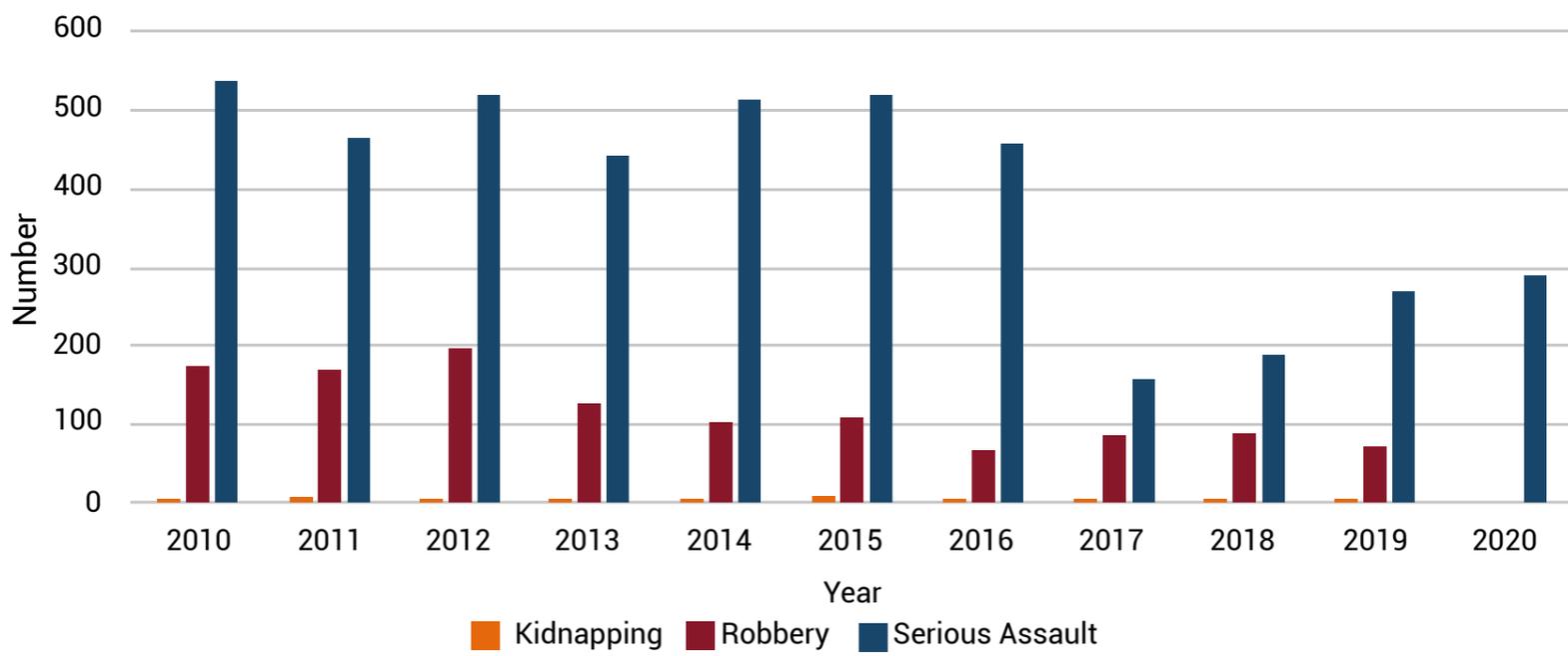
143 NationNews. 2022. "Call for tougher laws to fight elder abuse". <https://www.nationnews.com/2022/06/13/call-tougher-laws-fight-elder-abuse/>

**Figure 33: Victims of Intentional Homicide per 100,000 Population by Year**



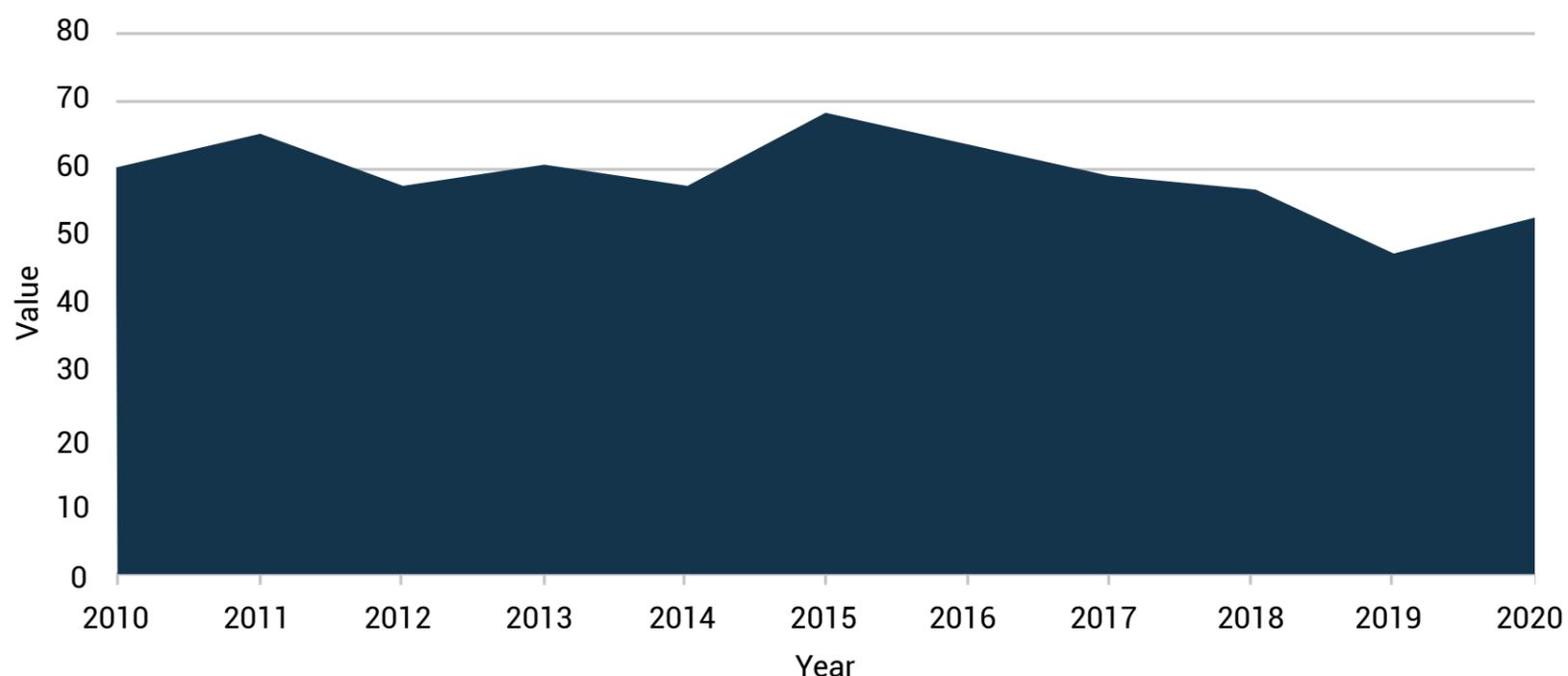
Source: The United Nations Office for Drugs and Crime, 2022

**Figure 34: Number of Recorded Offences for Selected Crimes per 100,000 Population by Year**



Source: The United Nations Office for Drugs and Crime, 2022

**Figure 35: Number of Recorded Victims of Sexual Violence Offences for Selected Crimes per 100,000 Population by Year**



Source: The United Nations Office for Drugs and Crime, 2022

### **Financial Shocks**

There are a series of exogenous shocks that can cripple a small and vulnerable economy like Barbados. Financial shocks arise from sovereign defaults on loans, liquidity shortages within essential public sector agencies and unprecedented levels of spending due to the presence of highly contagious communicable diseases such as COVID-19. Similarly, oil price shocks can affect the quality and quantity of daily activities conducted for either commercial or residential purposes. Financial shocks can also exacerbate the demand for fossil fuels thereby resulting in oil price shocks. The latter of which can occur as a result of changes in international regulations governing oil supply and oil demand. These issues, coupled with impacts of climate change, can exacerbate the risk profile for Barbados.

## 2.2 Vulnerability

Vulnerability refers to the “conditions determined by physical, social, economic and environmental factors or processes which increase the susceptibility of an individual, a community, assets or systems to the impacts of hazards,” (UNDRR, 2022). Vulnerability infiltrates social, environmental and economic boundaries, and is inextricably related to social processes in disaster prone areas (DEM, 2014). It highlights pre-existing vulnerabilities within a given country context such as fragility, susceptibility or lack of resilience when faced with distinct hazard events. Small Island Developing States like Barbados are constrained by their size, insularity and remoteness which makes countries highly susceptible to endogenous and exogenous shocks. As outlined by UNDRR, various faucets of vulnerability exist<sup>144</sup>. These include social, economic, physical, and environmental vulnerabilities, as seen in Figure 36.



### 2.2.1 Social Vulnerability

This underscores the socioeconomic and demographic factors that determine individuals' abilities to cope with hazards. This is essential, as oftentimes, the socially vulnerable are disadvantaged in disaster situations and are more adversely affected<sup>145</sup>. Vulnerable groups can be defined as “People who cannot comfortably or safely access and use the standard resources in disaster preparedness, relief and recovery”<sup>146</sup>. Factors such as poverty, ethnicity, gender, age, disability, literacy, language and household dynamics contribute to the social vulnerability landscape and render groups at risk. However, social vulnerabilities do not incur in vacuums, but rather form a complex landscape where the interplay among each other and within the wider context of vulnerability.

#### *The Extent of Poverty*

According to the 2021-2022 Human Development Report, an estimate for the Multidimensional Poverty Index (MPI)<sup>147</sup> for Barbados was derived from National surveys conducted over the period 2009-2020. In 2012, Barbados attained a MPI score of 0.009 - well above the Latin American and Caribbean average of 0.030. The extent of the population exhibiting multidimensional poverty by headcount was 2.5<sup>148</sup> which corresponded to 7000 persons. In terms of the Intensity of Deprivation within multidimensional poverty<sup>149</sup>, this estimate accounted for 34.2% of the population. There were no estimates for the following components under the category of 'population in multidimensional poverty': (i) Inequality amongst poor; and (ii) the

144 UNDRR. 2022. “Terminology – Vulnerability”. <https://www.undrr.org/terminology/vulnerability>

145 Flanagan et al. 2011. “A Social Vulnerability Index for Disaster Management”.

146 Centre for Disease Control and Prevention. 2012. “Identifying Vulnerable Older Adults and Legal Options for Increasing their Protection During All-Hazards Emergencies: A Cross-Sector Guide for States and Communities”.

147 The Multidimensional Poverty Index represents the proportion of the population that is multidimensionally poor adjusted by the intensity of the deprivations. See Technical note for details on how the Multidimensional Poverty Index is calculated: <https://hdr.undp.org/system/files/documents//mpi2021technicalnotespdf.pdf>.

148 The Multidimensional poverty headcount: indicates the extent of the population with a deprivation score of at least 33 percent. It is expressed as a share of the population in the survey year, the number of multidimensionally poor people in the survey year and the projected number of multidimensionally poor people in 2019.

149 The Intensity of Deprivation within multidimensional poverty is calculated as the average deprivation score experienced by people in multidimensional poverty.

extent of population in severe multidimensional poverty. The percentage of the Barbadian population that is vulnerable to multidimensional poverty is 0.5%<sup>150</sup> - that is 14,385 persons. Poverty amongst children within the Eastern Caribbean is well documented. In 2019, it was estimated that 32.6% or one in every three children live in poverty<sup>151</sup>. According to the 2019 UNICEF report, entitled 'A Situational Analysis of Children in the Eastern Caribbean', poverty amongst children can be disaggregated into child indigence and the overall child poverty rate. For Barbados, the child poverty rate (35.6%) and the child indigence rate (6.4%) demonstrated that children are more likely to live in poverty and face multiple deprivations.

### Unemployment

There is a direct correlation between poverty and unemployment - which in the case of Barbados is highly gendered. In 2016, the national unemployment rate stood at 8.25%<sup>152</sup> - with 21% of women live in poverty when compared to 14% for their male counterparts<sup>153</sup> whereas unemployment rates amongst women is 0.8 percentile points higher than for males<sup>154</sup>. Child poverty rates by the gender of the head of the household within Barbados reinforce this point. According to the UNICEF report, entitled 'A Situational Analysis of Children in the Eastern Caribbean', poverty amongst children from female headed households stood at 40.8% - 11 percentile points higher than in male dominated households. The unemployment rate in Barbados has skyrocketed since the onset of the COVID-19 Pandemic.

As a percentage of the Barbadian labour force, unemployment rates amongst adult women and men differed by approximately 4 percentile points. According to the 2016 Barbados Survey of Living Conditions, unemployment rates amongst adult women was higher (8.65%) than in adult males (7.85%). Similarly, youth unemployment amongst females was higher (28.35) than in males (25.13). In terms of the Labour Force Participation Rate, the overall ratio of females to males was 89.23% with minimal variation amongst the working-class females (61.87%) and males (69.34%).

<sup>150</sup> The World Bank. 2022. "The World Development Indicators". Datasets ranged from 1997 to 2021. The total population for Barbados at the end of 2021 was 287, 708 persons.

<sup>151</sup> UNICEF. 2019. "A Situational Analysis of Children in the Eastern Caribbean".

<sup>152</sup> The World Bank. 2022. " World Development Indicators. Datasets ranged from 1997-2021.

<sup>153</sup> The Barbados Survey of Living Conditions 2016-2017

<sup>154</sup> The Barbados Statistical Service. 2022. "Unemployment rate". <https://stats.gov.bb/?s=unemployment+rate>. The unemployment rate among women is 14.5 percent compared to 13.7 percent among men.

### Vulnerable Groups

Women, children, the elderly and the disabled community are adversely affected by hazardous events and face intersectional challenges in their resilience building efforts. In recognition of this, the GoB through its ministerial arm: The Ministry of Empowerment and Elder Affairs and the Ministry of Home Affairs and Information has embarked upon initiatives to assist these vulnerable groups. Such initiatives include:

- The Disaster Social Relief Plan make provisions individuals who require food, clothing or compensation in the aftermath of an emergency (Ministry of People Empowerment and Elder Affairs, 2022).
- The Barbados Companionship Programme which seeks to promote safeguarding but also greater community ties – particularly amongst those that considered isolated owing to the nature of their current living arrangements during the onset of the COVID-19 pandemic.
- The Adopt-A-Family Initiative sought to address the economic devastation felt by the abject poor because of the suspension of tourism-related activities and the national lockdown.

Similarly, the National Assistance Board acts as one of the Government's Social Assistance Agencies with direct responsibility for the administration of the Housing Programme, the Proposed Home Help Service and the National Day Care Programme. The board also provides a range of services for highly disadvantaged segments of the population - particularly the elderly and indigent persons. National assistance may be provided to a person who is in need by reason of his being prevented by some disability from earning a living, or who has no resources to maintain himself and is unable to find work and shall normally be given to the person who in the opinion of the Welfare Officer is the head of a family and whose needs shall be deemed to include those of his dependants. National assistance may consist of assistance in cash or in kind provided as a matter of necessity. A cash grant may be awarded— in the case of a person who—is so blind as to be unable to perform any work for which eyesight is essential, or is so deaf and dumb as to be incapable of effectively receiving and making verbal communication, for such period as the Chief Welfare Officer determines; in any other case, for any period of from 1 to 26 weeks duration, and may

be renewed on the expiration of such period. A cash grant awarded shall be payable at the appropriate rate prescribed by regulation 21 (1), and shall not at any one payment exceed an amount equal to two weeks grant. The rising cost of living will directly contribute to a household's increased reliance on the National Assistance Board.

The proportion of the population aged 65 years and over has been rising. In Barbados, this trend has been quite significant over the years as the nation's boast of being one of the leading countries in the world with the highest number of centenarians per capita. In 1999, persons 65 years and over accounted for around 11.3% per cent of their population and by 2021, this ratio accounted for almost 18% of the Barbadian population. With an increasingly aging population, more funds and resources must be generally allocated to healthcare services and associated amenities. In Barbados, there is a large proportion of funds primarily placed to treat non-communicable diseases. This, coupled with the incidence of low fertility rates will result in a labour-force deficit in the coming years. This will pose negative implications on productivity, labour costs and possible business expansions, and enhance the overall competitiveness of firms across intra-regional and extra-regional markets.

### **The Overall Health of the Barbadian Population**

The COVID-19 pandemic has undoubtedly exacerbated existing vulnerabilities and capacities within the Barbadian health sector. According to the World Health Organization (supplemented by Barbados country data), there were 5.97 hospital beds per 1,000 persons<sup>155</sup> in 2017<sup>156</sup>. Chronic non-communicable diseases are becoming more prevalent. Of the 190,000 Barbadians aged 20 years or over, it is estimated that 90,000 are overweight; 38,000 suffer from hypertension; 19,000 are diabetic; and one person suffers from a stroke on a daily basis (Government of Barbados, 2018). The related annual costs of the health care services delivered at the Queen Elizabeth Hospital amounts to 65% of its allocated budget. Prescription drugs and indirect costs have been estimated at approximately US\$ 138 million annually. Generally, the national health of Barbados has shown a decrease in the incidence of most communicable diseases (Government of Barbados, 2018).

155 Hospital beds include inpatient beds available in public, private, general, and specialized hospitals and rehabilitation centres. In most cases, beds for both acute and chronic care are included.

156 The World Bank. 2021 "Health, Nutrition and Population Statistics". Datasets ranged from 1997-2021.

Several national instruments contribute to reducing varying aspects that contribute to social vulnerability. These include the Social Protection Policy (2015), the National Adaptation Plan (2018) and the Medium-Term Development Strategy (2020). Notwithstanding these progressive steps, there remains an urgent need for detailed analyses of the social dimensions of these vulnerable groups to aid in understanding the intricate interaction of social circumstances and disaster risk, for targeted interventions.

### **Governance**

Political vulnerability constitutes the level of autonomy of a community to make decisions. It refers to the concentration of decision-making power, centralization in governmental organizations and weaknesses in political autonomy at the regional, local and community levels, (Wilches-Chaux, 1993). According to the United Nations Office on Drugs and Crime, Barbados is one of the safest countries in the world regarding its high degree of political stability and absence of corruption, rule of law, and control of corruption. In terms of disaster planning, the island has well established and highly coordinated entities with distinct roles and functions across the National Emergency Response Mechanism.

### **Cultural Beliefs**

Pre-existing social ideologies pose a major challenge to preparedness efforts to avert disaster risk. In terms of the severity of hazards, Barbados has been extremely fortunate over the last seventy years. Unlike its neighbouring territories, the island has experienced fewer and less devastating impacts when compared to economies like Jamaica, Antigua, the Commonwealth of Dominica and Grenada. Within many households, there are cultural attitudes that perpetuate vulnerability. This has led to a high degree of complacency in disaster management and emergency planning in light of pending hazard events.

### **Public Awareness Campaigns**

Educational vulnerability refers to the lack of educational programmes, inadequate instruction or instructors, capacity and materials, unavailability of education programmes that include disaster risk reduction at local and regional levels, the community's level of understanding of the issues involved in include disaster risk reduction. There is limited educational vulnerability in this regard owing to the government's proactive stance of informing the public on national security issues via various modes of media. This includes its primary government information portal (the Barbados Government

Information Service) and through dedicated ministerial bodies. These include: the Ministry of Health; the Ministry of People's Empowerment and Elder Affairs and the departmental or voluntary arms that fall under the auspices of the Department for Emergency Management.

### Labour Force Dynamics

Even though Barbados is generally regarded as having a highly skilled labour force, there is a paucity of skills within the environmental, agro-industry, agriculture, fisheries, housing and building industries (Government of Barbados, 2018). In addition to this, many young professionals have sought careers within metropolitan countries noting the high incidence of unemployment on the island. This negative net migration also compromises the extent of skilled labour within the labour force as it contributes to brain drain. There are existing technical capacity constraints within many public sector agencies. This has generally hampered the quantity and quality of work achieved in comparison to an organization's annual goals, objectives and proposed outcomes.

## 2.2.2 Economic Vulnerability

Barbados is considered as one of the top ten most indebted countries in the world<sup>157</sup> in terms of its debt to GDP ratio which stood at 137% in 2021 (World Development Indicators, 2022). This current state of affairs limits the country's adaptive capacity to cope with exogenous shocks such as natural hazards, oil shocks and financial shocks. In June 2018, as a response to the worsening fiscal and external liquidity position, the GoB announced its homegrown Barbados Economic Recovery and Transformation (BERT) Plan aimed at restoring macroeconomic stability whilst safeguarding the financial and social sectors. The nature of the debt restructuring employed was applauded by the International Monetary Fund. In late September 2022, Barbados was granted an IMF Extended Fund Facility via a newly established Resilience and Sustainability Trust (RST) to help build resilience against climate change; to reduce public debt while facilitating capital expenditure to boost growth; and to transition the economy to a 100% green economy by 2030<sup>158</sup>. Issues regarding the island's high debt levels were exacerbated during the passage of

Tropical Storm Kirk which required substantial financing for flood relief (See Box 1).

## 2.2.3 Physical Vulnerability

Physical vulnerability is defined as "the conditions determined by physical processes which increase the susceptibility of an individual, a community, assets or systems to the impacts of hazards." Barbados is the one of the most densely populated country in the Western Hemisphere. It is divided into eleven (11) parishes and has four main historical towns: Bridgetown, Speightstown, Holetown and Oistins. On the island, the capital and Central Commercial District is Bridgetown. According to results obtained from the 2010 Barbados Population Census<sup>159</sup>, approximately 73% of the Barbadian population is settled along the south, south-east, southwest, and western coasts of the island. Predominately, this correspondences to the coastal parishes of Christ Church, Saint Philip, Saint Michael, and Saint James - with a vast majority of the island's infrastructure and many communities being situated within 2 kilometres of the coastline. This therefore exacerbates the risk from climate change impacts - particularly sea level rise, coastal flooding, and storm surges.

### Road Networks

Based on the 2019 Global Economy's Road Quality Index<sup>160</sup>, Barbados is classified as having some of the worst roads in the world with approximately 70% of the roads in a state of disrepair<sup>161</sup>. In terms of the road network, the geology of the island is quite limiting owing to its coral limestone origins. As the geology on the island is highly porous, the formation of depressions within the road network are quite prevalent especially during intense periods of rainfall and or flooding. This not only increases the likelihood of vehicular damage but also personal injury. Similarly, a vast majority of the island's economic and infrastructural capital assets are located along the western and southern corridors – low-lying regions that are highly prone to extensive flooding. Such assets include the Bridgetown Deepwater Harbour, hospitals, hotels, coastal highways, major urban centres, desalination plants and basic service infrastructure (electricity,

157 Government of Barbados. 2021. "Govt on a 'borrowing binge'". <https://barbadostoday.bb/2021/08/26/govt-on-a-borrowing-binge/>

158 BGIS. 2022. "Barbados Reaches Deal On New Extended Fund Facility". <https://gisbarbados.gov.bb/blog/barbados-reaches-deal-on-new-extended-fund-facility/>

159 The National Census for Barbados is conducted every ten years. The 2010 numbers consider an undercount of 18%. The 2020 Census for Barbados was delayed as a result of the onset of the COVID-19 Pandemic.

160 Barbados was ranked 108th attaining a score of 3.2 over the period 2006-2019. [https://www.theglobaleconomy.com/rankings/roads\\_quality/](https://www.theglobaleconomy.com/rankings/roads_quality/)

161 Barbados Today. 2019. "Bad roads across Barbados". <https://barbadostoday.bb/2019/02/20/bad-roads-across-barbados/>

health and public safety). This highlights a significant multi-faceted challenge because assets are becoming increasingly vulnerable to coastal erosion, thermal extremes, flood run-off and climate change impacts.

### Transportation Systems

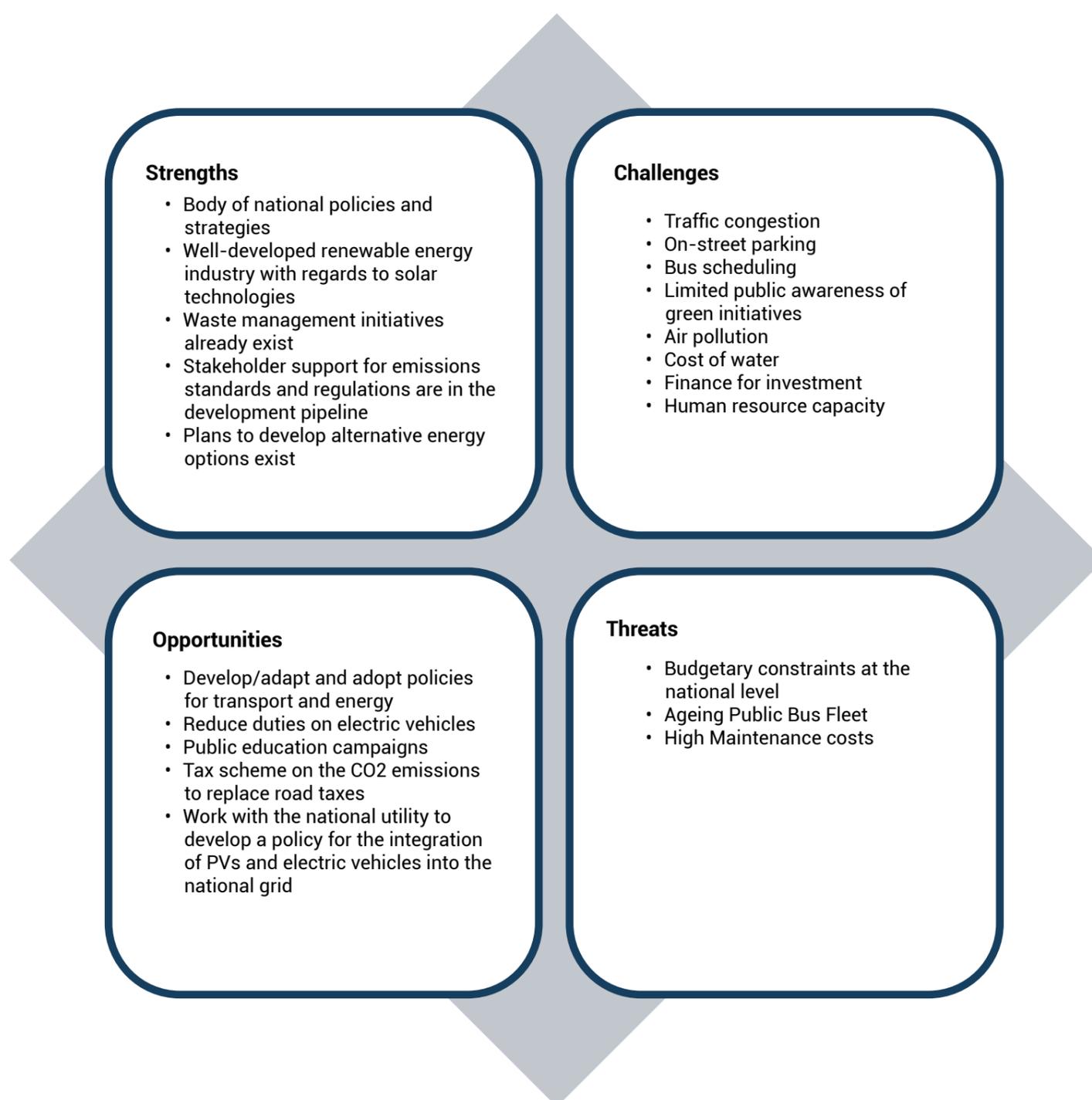
Even though the transportation system on the island is highly advanced, there are several notable strengths, challenges, opportunities and threats as seen in Figure 37. For instance, inefficiencies within the Barbados Transport Board often result in higher costs for the GoB. Moore et al., 2014 notes that key inefficiencies in the transport board include:

- High Maintenance Costs (fleet repairs at over 20% of costs in the 2014-2015 and 2016-2017 financial years);

- High Staffing Levels relative to number of vehicles - despite cost reductions over the last five years; and
- Central Government shouldering the Barbados Transport Board's large debt in recent years.

Within the 2018-2019 financial year, the Barbados Transport Board received a budget increase - plus debt relief. These actions were highly indicative of backsliding on previous savings efforts. In addition to this, recent efforts to purchase new vehicles from Central Government funds arguably misses the objective of running a State owned Enterprise with clear revenue potential, which should be responsible for capital maintenance and replacement.

Figure 37: A SWOT Analysis of the National Transportation System

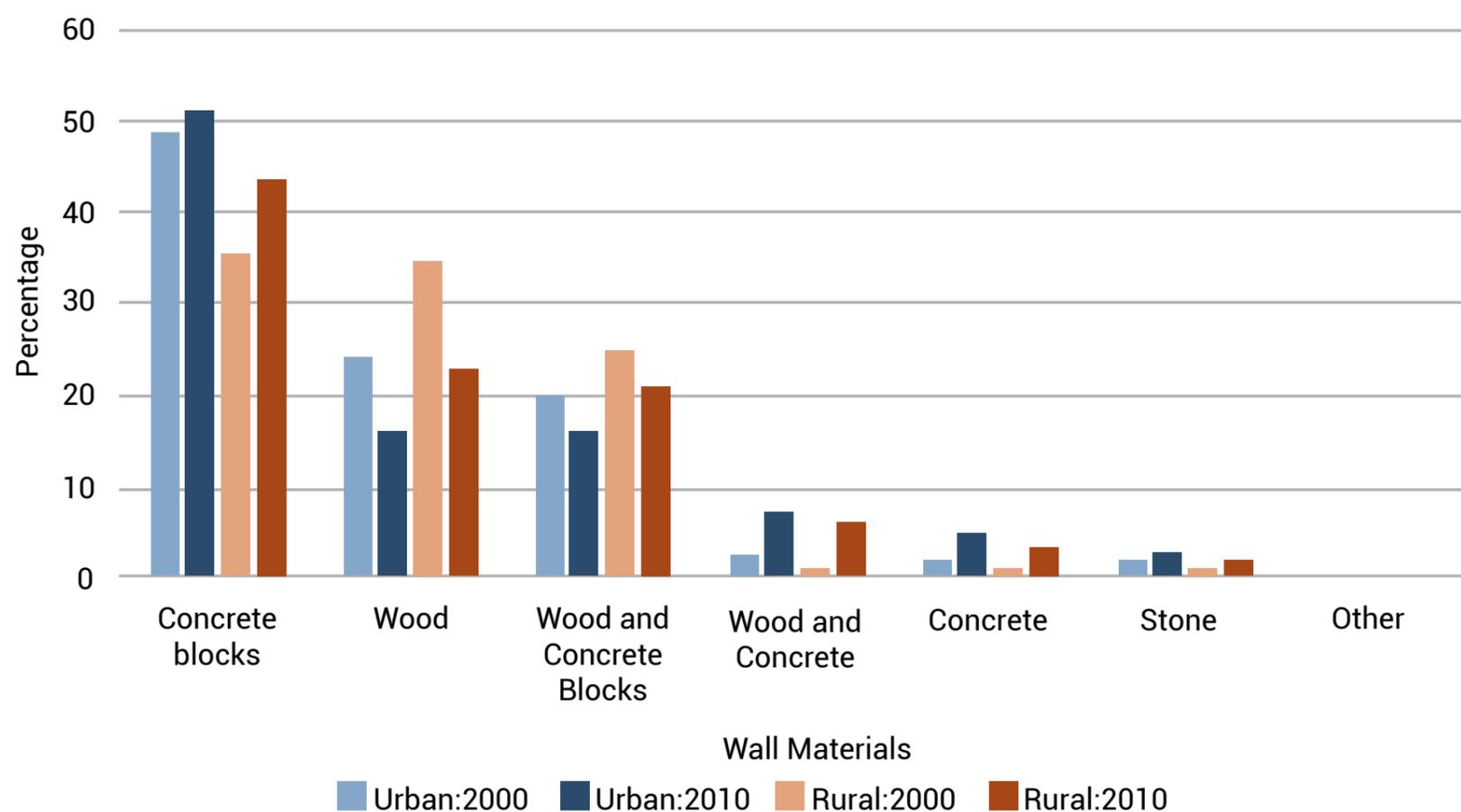


Source: Moore et al., 2014

### Housing stock

Despite the fact that there is no nationally recognised building code, the Barbadian housing stock has typically been built to withstand a one-in-one-hundred-year storm. This is increasingly challenging noting the change in trajectory and increased intensity of hydrometeorological hazards in recent times. According to the 2015 Barbados HABITAT III Report, wall materials used within the rural and urban corridors are comprised of concrete, wood and stone to varying degrees (as seen in Figure 38). Up until the 1970s, Barbados' low-income houses were typically comprised of timber and this accounted for approximately 30,000 dwellings (Watson et al., 2001). More recently, the construction of concrete homes has increased by more than 50% in some urban areas. Even though there has been a gradual transition towards concrete structures, wooden low-income homes still predominate several rural districts and are deemed as highly vulnerable to hurricanes and other extreme weather events. Noting the extensive damage arising from the passage of hydrometeorological systems in recent times, the GoB has explored viable alternative housing solutions. This includes the utilization of steel houses<sup>162</sup> in efforts to circumvent this problem thereby minimizing the disaster risk posed by major displacement - problems that arose after the passage of Hurricane Elsa<sup>163</sup> in July 2021<sup>164</sup>.

**Figure 38: The Nature of Wall Materials used across the Urban and Rural Corridors**



Source: The Barbados HABITAT III Report, 2015

Note: Data was obtained from the 2000 and 2010 Barbados Housing and Population Censuses compiled by the Barbados Statistical Service.

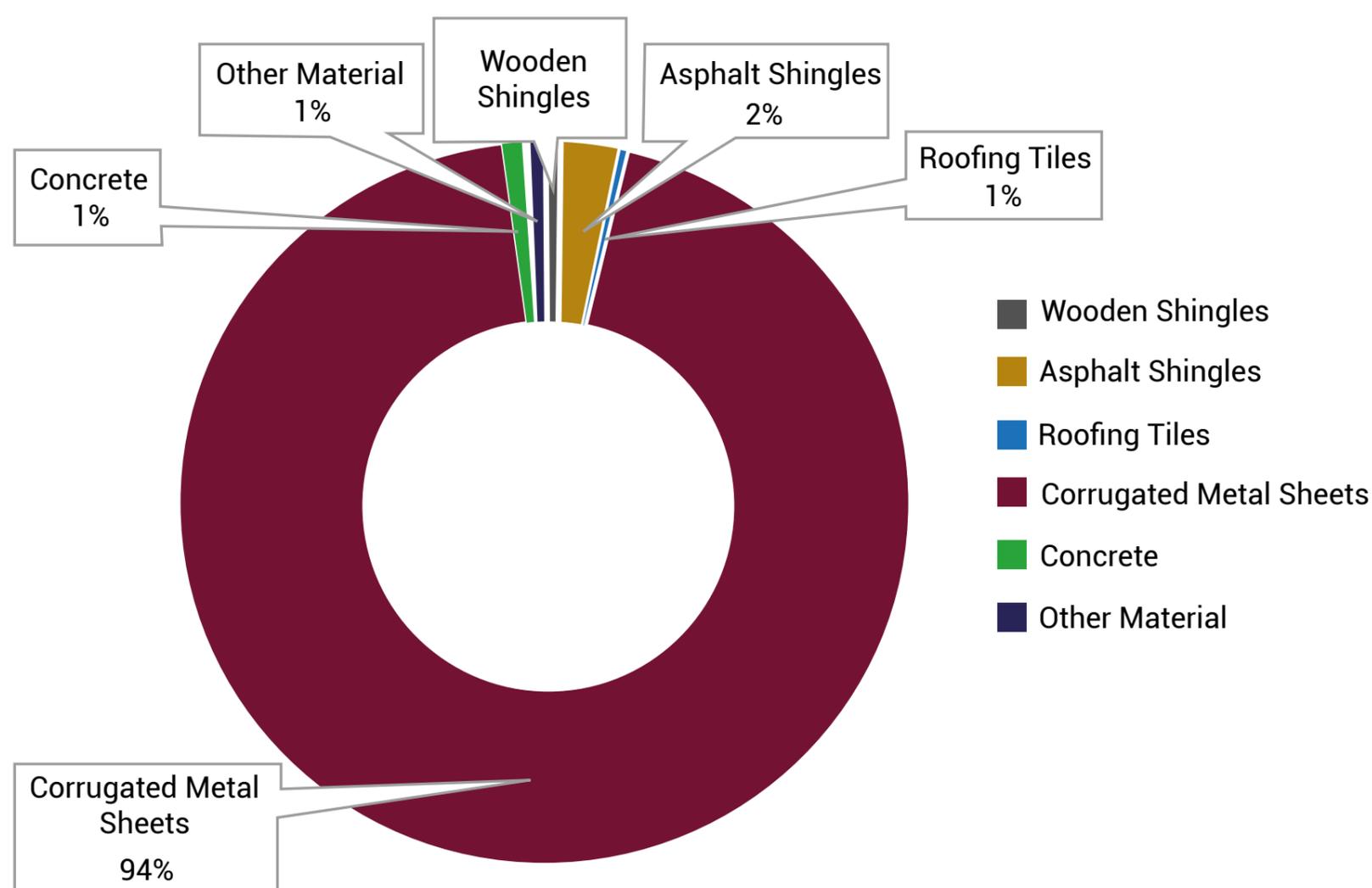
162 BGIS. 2022. "Statement on Construction of Steel-Framed Houses From China". <https://gisbarbados.gov.bb/blog/statement-by-housing-minister-on-the-construction-of-steel-framed-houses-from-china/>

163 BGIS. 2021. "DEM Reports On Damage From Hurricane Elsa". <https://gisbarbados.gov.bb/blog/dem-reports-on-damage-from-hurricane-elsa/>. Initially, the Department of Emergency Management noted that 2,372 problems reported: (1,333 reports of roof damage; 326 reports of other house damage; 145 reports of total house collapse)

164 EM-DAT | The international disasters database. 2022 "Custom Request for types of hazards affecting Barbados".

In terms of roofing materials, results obtained from the 2010 Barbados Housing and Population Census indicate that approximately 94% of all houses are constructed using corrugated metal sheets (as seen in Figure 39). However, there are some informal construction practices across Barbados that fail to meet the recognised standard. However, there are some informal construction practices across Barbados that fail to meet the recognised standard. These include the orientation of houses, the height and angle of roofs as well as the absence of roof straps – all of which are contributing factors to the extent of damage encountered during high intensity events such as high winds. Such instances were apparent during the passage of Hurricane Elsa in July 2021 and emphasized the need to employ national measures to retrofit the island's built environment .

**Figure 39: The Nature of Roofing Materials in Barbados**



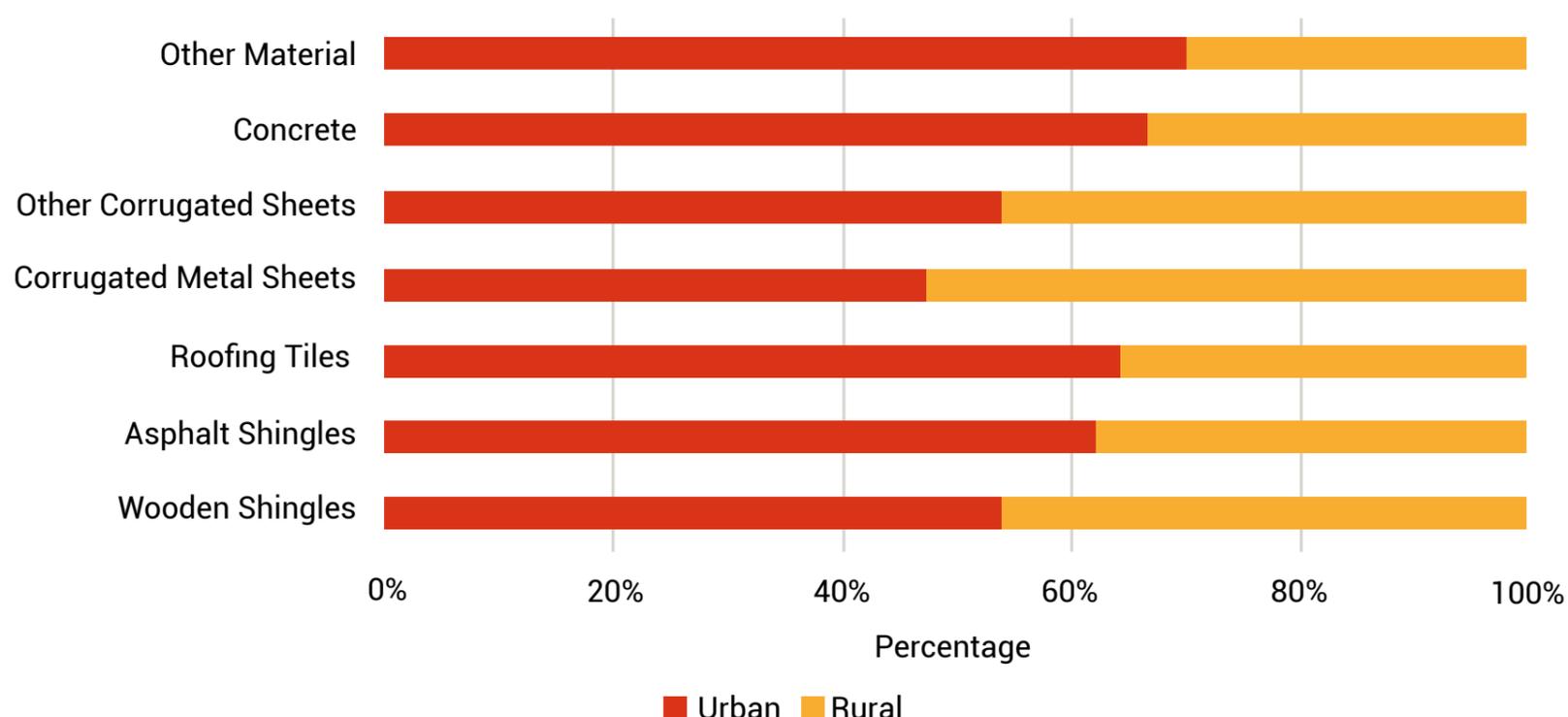
Source: The Barbados HABITAT III Report, 2015

Note: Data was obtained from the 2000 and 2010 Barbados Housing and Population Censuses compiled by the Barbados Statistical Service.

Similarly, the range of roofing materials used across the rural and urban corridors can be disaggregated by type (as seen in Figure 40). In terms of the extent of overcrowding<sup>165</sup>, segments of the urban (0.28%) and rural (0.27%) population are classified as such based on results obtained from the 2010 Barbados Housing and Population Census. Such instances will pose serious implications for rationing in the event that major national catastrophes arise.

<sup>165</sup> Sufficient living space which means not more than three people sharing the same room. Information from the Barbados Statistical Service (BSS) in relation to number of rooms in the house and number of persons in the household for 2010. For households allocated as '13 or more persons', less than 5 rooms are considered overcrowding given information that the largest household contains 15 persons.

**Figure 40: The Nature of Roofing Materials used across the Urban and Rural Corridors**



Source: The Barbados HABITAT III Report, 2015

Note: Data was obtained from the 2000 and 2010 Barbados Housing and Population Censuses compiled by the Barbados Statistical Service.

Through its newly developed National Adaptation Plan called the Barbados Roofs to Reefs Programme (R2RP), the GoB has spearheaded efforts to promote island-wide resilience to hazards and disasters. Under the R2RP, building resilience in the low and middle-income housing stock will include:

- i. Fortifying the roofs, windows, and doors of buildings, including low- and middle-income housing, to withstand up to Category 4 hurricane wind speeds (157 mph);
- ii. Furnishing grid-tied rooftop solar photovoltaic systems (with battery storage in the event of grid loss). Installation will be conducted under a to-be-established protocol/code to reduce the risk of losing the panels in an extreme wind event;
- iii. Installing modern rooftop rainwater harvesting systems and stormwater drainage to improve both water storage capacity and groundwater recharge rates;
- iv. Providing potable water storage systems to increase resilience to drinking water shortages; and
- v. Building modern, cost-effective, affordable household or communal waste-water treatment systems, with particular emphasis

on nutrient removal/recovery (closing the nitrogen loop) to protect vital coastal reefs.

Applying these measures consistently requires a policy to retrofit and build up the resilience of low and middle-income structures in the medium term. In addition to this, guidelines to construct new climate resilient housing for these low- and middle-income housing segments of the population.

#### **Sick buildings**

With major economic advancements comes major developments via the establishment of institutions, legislative policies and or initiatives. However, there is a growing phenomenon of sick buildings across Barbados that encapsulates the public, the private sectors as well as academic institutions. Over the last 15 years, there has been an increase in the Sick Building Syndrome<sup>166</sup>. This syndrome arises as a result of inadequately scheduled maintenance checks on buildings and their environs; and a lack of personnel to conduct such activities due to heavy constraints on the national budget. The increasing likelihood of Sick Building Syndrome in Barbados poses many challenges to the productivity, health and safety of the Barbadian populace. The proliferation of pests, insects and microorganisms - particular those that act as hosts for various air-

<sup>166</sup> Barbados Advocate. 2021. "Maintenance key to prevent sick buildings". <https://www.barbadosadvocate.com/news/maintenance-key-prevent-sick-buildings>

borne, water-borne and vector-borne diseases will not only reduce the productivity of individuals retained within the public sector, the private sector and academic institutions but also pose an additional strain on the health sector. In instances of extreme events, newly classified sick buildings that in the past were deemed as national shelters will be disavowed, and additional facilities will be sought to facilitate the movement of persons particularly those from disadvantaged groups during extreme events.

### Sanitation

Failure to regularly collect the significant volumes of solid waste generated within a highly densely populated island like Barbados poses grave challenges to national disposal efforts. Such waste is generated by the importation of large volumes of consumer items and is directly correlated to residents' high per capita income, the island's high standard of living and annual stay-over tourist arrivals that almost double the local resident population at any given time. As a result, national disposal efforts will be exacerbated during instances of extreme weather and may result in blockages within storm water drainage systems.

In spite of an established system of waste management comprising of government programmes, private entities and business initiatives, waste management has proven to be a major challenge in the last twenty years. Specific challenges include illegal dumping by private citizens and businesses in gullies, quarries and on the roadsides. This has consequences on the health and human wellbeing of the citizens as insects and pests (mosquitoes, rats and mice), illegal dumps and stockpiles of vegetation, tires and old containers are sources of vector-borne diseases. There is also the associated adverse impact of dumping on marine and coastal resources. Finally, an emerging issue is finding an economically viable means to dispose non-biodegradable packaging generated through foreign imports and local producers and retailers.

### Water Infrastructure

Barbados is demarcated into a series of water protection zones that limit the extent of physical development to varying degrees (see Section 1.3.7). Water quality on the island is managed via the Barbados' Groundwater Protection Zoning Policy. The policy regulates the protection of water sources from environmental pollutants across five water protection zones which have been demarcated to allow varying degrees of physical development<sup>167</sup> -

<sup>167</sup> Zone 1 is the most restrictive due to proximity to drinking water production wells, whereas in Zone 5 the provisions for development are most relaxed.

with 'decreasing stringencies from Zone 1 to Zone 5'. The policy also includes measures on private sewage and wastewater disposal systems, which provides control over any liquid waste disposal systems that could potentially damage the ground water resources abstracted for domestic use.

The threat posed by groundwater contamination is the relatively high. This threat is not only attributable to saltwater intrusion, but also illegal squatting, illegal dumping and chemical contamination arising from commercial and agricultural practices.

There has been an increase in illegal settlements along with legal physical developments for residential and commercial uses. These not only increase the likelihood of groundwater contamination severely compromising the groundwater quality but also alter natural water courses that follow the topography of the land. If water courses are constricted during instances of rainfall, it may result in extensive flooding.

Illegal squatting and urban sprawl has been widely recognised in the parishes of St. Michael and St. Philip<sup>168</sup>. When such practices occur within prohibited water protection zones, it poses a direct threat to the quality of potable water. Settlements within Bellevue, St. Michael are located within Zone 1 – an area with the 'highest stringencies on physical development'. Dwellers are not connected to the main water supply and therefore function with a lack of piped water and proper sewage facilities. As a result, waste products associated with residential activities are deposited into nearby gullies. This allows waste products to seep into the gully systems which act as a main conduit for rainwater into the aquifers. Waste products then reach soak away pits that are located immediately above key aquifer resources and this contributes to ground water contamination within abstraction wells. In the past, 'high concentrations of nitrates and high levels of bacteria' were observed (EPD, 2009).

Illegal dumping creates unattractive sites and hampers efforts to promote the effective management of ecosystems. The island is characterized by an extensive gully system which as a main conduit for rainfall to the aquifers. However, these land formations informally act as uncontrolled disposal sites for large scale appliances, vehicles and decomposing animal matter. Noting such, the incidence of seepage into the underground water table is enhanced. Such seepage is also associated with heavy metals, oils, and chemicals.

<sup>168</sup> Illegal squatting has been noted in Bellevue, St. Michael; Howells Cross Roads, St. Michael and; Rock Hall, St. Philip.

Commercial and industrial practices are associated with the large-scale use of chemicals and derivatives that may be deemed as potentially hazardous and pose a significant threat to humans in large concentrations. Such chemicals include cleaning reagents, pesticides and herbicides which are composed of heavy metals, oils, acids, and bases. 'There is a paucity of available data to determine the extent of and the composition of the effluent discharge by many operations' (EPD, 2009; DEM 2014). Strict adherence to the national zoning policy and chlorination efforts seeks to avert future risk by addressing the incidence of bacterial contamination. However, the effectiveness of measures employed to negate the incidence of chemical contamination has become an increasingly growing concern (Headley, 2002; DEM, 2014). To avert future risk, the promotion of activities that facilitate sustainable consumption and production practices have been widely introduced.

### **Sewage Infrastructure**

The South Coast Sewage crisis represented a major setback for economic development. Not only did it over-emphasized the extent to which lives and livelihoods were correlated to the island's tourism product and cast a negative light on Barbados' reputation as a tourist destination but also highlighted the importance of maintenance, verification and reporting of public infrastructure. While an emergency outfall was eventually constructed in late 2018, it was not designed to be a long-term solution and is vulnerable to strong waves, which could result from storm wind conditions (CDB, 2019).

### **Information Technology Infrastructure**

Barbados has a sophisticated information technology infrastructure. Owing to economies of scale, the island has a sole water supplier and a sole electricity provider. Within the Barbados Water Authority, there is extensive bureaucratic red tape to get issues rectified (breaks in water main and water outages) and a lack of coordination in maintenance efforts with other public utilities across the island. This generally leads to long delays, road disruptions along major transportation networks and significant water losses as a result of prolonged leakages<sup>169</sup> which either translate into increased operating and maintenance costs for the BWA and or the end user<sup>170</sup>. Such situations become exacerbated in

extreme weather events, when not only the water quantity but also the quality of the resource is highly susceptible to saltwater intrusion.

Similarly, the Barbados Light and Power has requested several rate increases in the past few years deeming that the industry is not highly profitably noting the subsequent oil price shocks on the international market. As the sole utility company on the island responsible for power generation, this poses severe challenges to the island's energy security because the current infrastructure is highly susceptible to faults not only under 'business-as-usual' scenarios but also during extreme weather events. This has resulted in community-wide or island wide blackouts. This was the exceptional case during the passage of Hurricane Elsa in July 2021 as the entire population was without electricity for almost 10 days. As a result of such, there have been national awareness campaigns to sensitize the public on alternative energy sources and emergency preparedness.

## **2.2.4 Environmental Vulnerability**

This is determined by the intrinsic environmental limits of living organisms when faced with exogenous shocks. These include extreme temperatures, the vulnerability of ecosystems to direct and indirect human action, and the high risk associated with communities that exploit or inhabit them. The major environmental challenges for Barbados can be summarised as follows:

- Inadequacy and Reliability of Freshwater Supply
- Food Insecurity
- High Cost and Inefficient Use of Energy
- Degradation of Coastal Ecosystems

### **Inadequacy and Reliability of Freshwater Supply**

Leachate infiltration into the groundwater aquifer from illegal dump sites in gullies continues to be problematic and can pose a significant long-term threat to the potable water supply. Similarly, advances in development have been accompanied by increased use of chemicals for agriculture, industry and transport to name a few. This has resulted in increased amounts of Persistent Organic Pollutants (POPs) as well as lead, mercury and other heavy metals. Effective management of these chemicals is therefore necessary to avoid detrimental impacts on human health and contamination of groundwater and coastal ecosystems.

<sup>169</sup> Barbados Today. 2022. "BWA addressing burst water mains across the island". <https://barbadostoday.bb/2022/05/15/bwa-addressing-bursts-across-the-island/>

<sup>170</sup> Barbados Today. 2022. "Elderly man questions \$12 000 water bill". <https://barbadostoday.bb/2022/01/13/elderly-man-questions-12-000-water-bill/>

### **Food Insecurity**

The island's topography is directly correlated to soil development. This, coupled with limitations in its natural resource base, poses some restrictions on the nature of commodities and crops produced locally. Furthermore, persistently low rainfall patterns - even in the designated wet season also exacerbate the situation as the island mainly depends on aquifers for its water supply. Global food prices have sharply increased since the onset of the COVID-19 Pandemic. This present-day scenario has in turn affected domestic food prices. As of March 2022, food inflation in Barbados stood at 19.6% (see Section 1.3.8) and has negatively impacted access to food by reducing one's purchasing power. To avert these risks, the GoB has sought assistance from Sub-Saharan Africa, Cuba and CARICOM Member States with large natural resource bases - particularly Guyana. Such collaborations not only seek to strengthen intra-regional ties but also to boost the island's agriculture sector and to ensure the continuation and expansion of imports to help meet local needs and demands.

### **High Cost and Inefficient Use of Energy**

Barbados has universal access to electricity; however, the cost of energy therefore has a significant impact on the Barbadian economy. While there are negative environmental impacts from use of fossil fuels such as pollution, the government's initiative to promote less reliance on fossil fuel is fundamental as a result of the economic burden of unpredictable oil prices, the drain on foreign exchange and the opportunity costs of maintaining the status quo - use of resources that could be employed to combat other development issues.

### **Degradation of Coastal Ecosystems**

Development along this coast has witnessed encroachment of buildings into the active beach zone, loss and degradation of significant wetlands, degradation of coral reefs and coastal water quality and loss of public beach access. These negative changes impact on the livelihoods and well-being of many Barbadians including fishers, hoteliers and other related businesses.

## 2.3 Exposure

Exposure refers to the "situation of people, infrastructure, housing, production capacities and other tangible human assets located in hazard prone areas"<sup>171</sup>. Even though Barbados

is generally regarded as an outlier within the Caribbean Archipelago, it is still exposed to an array of hazards noting the island's close proximity to the Lesser Antilles Subduction Zone. This high-risk zone is characterised by a mid-ocean ridge with significant volcanic and seismic activity. The region is also high susceptibility to tropical cyclone activity noting the westerly track of all hydrometeorological systems. The island is relatively flat in comparison to neighbouring territories and is therefore highly prone to climate change impacts such as sea level rise and associated coastal hazards. Approximately 24% of the island consists of sedimentary deposits that make up the Scotland Series. Noting the geology of the area, it is highly prone to land slippage. These underlying vulnerabilities, when coupled with development practices such as settlement patterns and infrastructure development, magnifies the country's vulnerability to hazard impacts.

Barbados' high income per capita has precluded it from acquiring developmental assistance from the World Bank Group - a feat easily accomplished by most neighbouring territories within the Caribbean Archipelago during instances of national hazards and disasters. This realization is particular challenging noting Barbados' extremely high current debt level along with its inherent characteristics as a Small Island Developing State that make it increasingly susceptible to exposure. Most of the island's activities are concentrated along its narrow coastal belt. In particular, essential economic activities include tourism, manufacturing, major transportation networks and other critical infrastructure. Similarly, most of the country's population reside within 2 kilometres of the coastline where there are limited opportunities for expansion noting the stipulations within the national zoning policy, existing prohibitions regarding expansions in particular residential communities and the possibility of land encroachment on natural or historical formations. The island's low-lying topography makes it highly susceptible to a vast number of climate-related hazards along the coast. These include tropical cyclones, storm surges and increased precipitation levels. These climate-related hazards are associated with an increased risk of flooding - particularly along the western coast.

<sup>171</sup> United Nations General Assembly. 2016. Report of the open-ended intergovernmental expert working group on indicators and terminology relating to disaster risk reduction.

# Governance Frameworks to facilitate Disaster Risk Reduction

## Chapter 3 Overview

This chapter provides a synopsis of the institutional frameworks governing disaster risk reduction at the international, regional national and local levels. International frameworks such as the Sustainable Development Goals, the Sendai Framework for Disaster Risk Reduction, the Paris Agreement on Climate Change, the SAMOA Pathway, Agenda 21, the Barbados Programme of Action, the Johannesburg Declaration and plan as well as the Mauritius Strategy for Implementation all underscore a global commitment to address environmental concerns. At the regional level, commitments made by the Caribbean Community reaffirm the need for a highly coordinated and coherent response to address disaster risk noting their similar yet differentiated challenges. At the national level, overarching policies guide the national discourse on environmental matters. These include the National Strategic Plan of Barbados, the Medium-Term Development Strategy, the Physical Development Plan, the Barbados Roofs to Reef Programme, the National Comprehensive Disaster Management Policy, the National Comprehensive Disaster Strategy and Framework, the Draft National Climate Change Policy, the Draft Barbados Integrated Coastal Zone Management Plan, the Disaster Social Relief Plan, the 2008 Throne Speech and the Barbados Sustainable Development Policy. These overarching policies are aligned with sectoral coordination and initiatives across various thematic areas in efforts to achieve the island's proposed goals and objectives over the short, medium and long term. Cognisant of the important role of society in addressing disaster risk, various activities have been conducted across Barbados via the island's District Emergency Organizations. Such activities emphasize the importance of a bottom-up approach to address current disaster risks and to hence minimize future risks and associated impacts.

## 3. Governance Framework

This section provides an overview of governance frameworks as the international, regional, national and community levels.

### 3.1 International Framework

This section provides an overview of international frameworks that facilitate disaster risk reduction efforts across the globe.

#### 3.1.1 The Sustainable Development Goals

The United Nations General Assembly adopted the 2030 Agenda for Sustainable Development which incorporates the seventeen (17) Sustainable Development Goals (SDGs) in 2015. The SDGs serve as a call to action for countries to implement to ensure peace and prosperity for all persons. The agenda recognizes that poverty eradication must be accomplished through a holistic approach with considerations for health, education, environmental sustainability, and climate change. Barbados has committed to the sustainable development agenda. Barbados is also party to the Addis Ababa Action Agenda that provides a financing framework for implementing of the 2030 Agenda for Sustainable Development.

Figure 41: The United Nations Sustainable Development Goals



Source: The United Nations Sustainability Platform

### 3.1.2 The Sendai Framework for Disaster Risk Reduction

The Sendai Framework for Disaster Risk Reduction 2015–2030 was adopted at the Third United Nations World Conference on Disaster Risk Reduction held in Japan during 2015. The Framework replaces the previous Hyogo Framework for Action 2005-2015: Building the Resilience of Nations and Communities to Disasters and provides countries with concrete actions to reduce disaster risk. It recognizes that the state has the primary role to reduce disaster risk but that the responsibility must be shared with other stakeholders including local government, the private sector, and communities. The Sendai Framework establishes four priority areas for action and seven targets (comprising 38 indicators) through which member countries can measure their progress. Like much of the global community, Barbados has adopted the Sendai Framework. The country’s main policy development initiative<sup>172</sup> – The Barbados Roofs to Reefs Programme aims to fulfil obligations under the Sendai Framework as it relates to coherence with the sustainable development agenda.

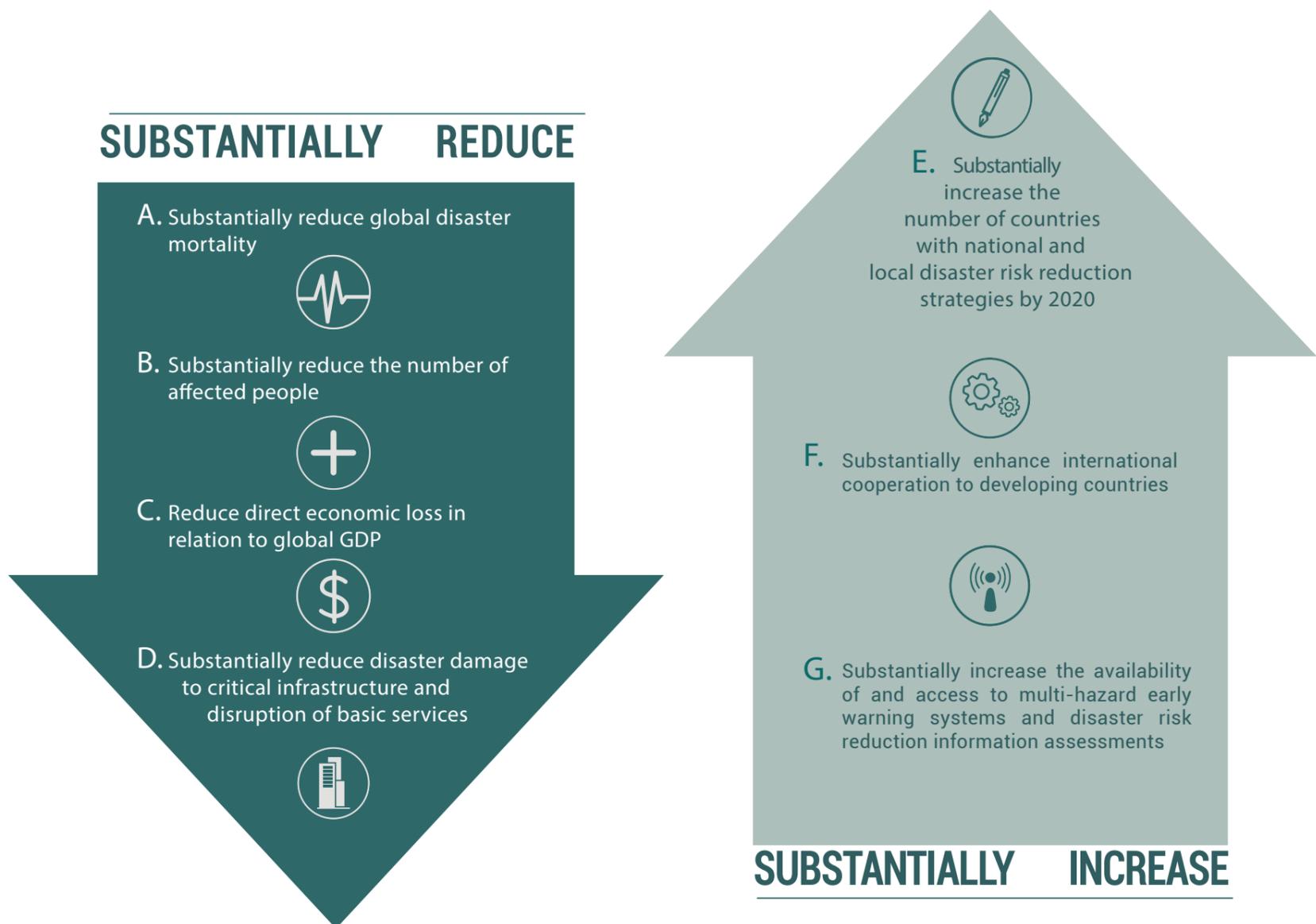
<sup>172</sup> The 2020-2027 Edition of the Medium Term Growth and Development Strategy for Barbados is currently being finalized.

Figure 42: Priority Areas for Action under the Sendai Framework for Disaster Risk Reduction



Source: The Sendai Framework for Disaster Risk Reduction 2015-2030

Figure 43: Seven Global Targets under the Sendai Framework for Disaster Risk Reduction



Source: The Sendai Framework for Disaster Risk Reduction 2015-2030

### 3.1.3 The Paris Agreement on Climate Change

In response to the growing global threat of climate change, the Conference of Parties (COP) 21 in 2015, produced the first legally binding agreement that brings all nations into a common cause to undertake ambitious activities to mitigate against and adapt to climate change. Recognizing the impacts that anthropogenic activities have on climate change, the Paris Agreement was established to limit global warming to well below 2 degrees Celsius (ideally to 1.5 degrees Celsius), compared to preindustrial levels. This is imperative for SIDS where climate change impacts are significant. Under the Paris Agreement, countries spearheaded the development of their Nationally Determined Contributions (NDCs), in response to climate change. In July 2021, Barbados submitted its Updated Nationally Determined Contribution to the United Nations Framework Convention on Climate Change.

### 3.1.4 The Small Island Developing States Accelerated Modalities of Action (SAMOA) Pathway

The SAMOA Pathway was instituted to promote sustainable development across SIDS due to their unique yet differentiated challenges. The framework establishes the following thematic areas to promote sustainable development across SIDS: climate change, inequality, green and ocean-based economies, sustainable energy, food security and waste management.

### 3.1.5 Agenda 21

Agenda 21 represents a comprehensive plan of action taken at all levels of development across the United Nations System, National governments and Major Stakeholder Groups in every thematic area to address human impacts on the environment. This Agenda, along with the Rio Declaration on Environment and Development, and the Statement of principles for the Sustainable Management of Forests, were adopted by more than 178 Governments at the United Nations Conference on Environment and Development (UNCED) held in Rio de Janeiro, Brazil, 3 to 14 June 1992. The full implementation of Agenda 21, the Programme for Further Implementation of Agenda 21 and the Commitments to the Rio principles, were strongly reaffirmed at the World Summit on Sustainable Development (WSSD) held in Johannesburg, South Africa from 26 August to 4 September 2002.

### 3.1.6 The Barbados Programme of Action

This was established in 1994, under the UN General Assembly resolution 47/189, during the United Nations Global Conference on the Sustainable Development of SIDS in Barbados. The Barbados Programme of Action for the Sustainable Development of SIDS (BPOA) recognizes the common but differentiated challenges faced by SIDS:

- A narrow resource base depriving SIDS of the benefits of economies of scale;
- A small domestic markets and heavy dependence on a few external and remote markets;
- High costs for energy, infrastructure, transportation, communication and servicing;
- Long distances from export markets and import resources;
- Low and irregular international traffic volumes;
- Little resilience to disasters;
- Growing populations;
- High volatility of economic growth;
- Limited opportunities for the private sector and a proportionately large reliance of their economies on their public sector; and
- Fragile natural environments.

As a 14-point programme, the Barbados Programme of Action for the Sustainable Development of SIDS (BPOA), identifies priority areas and specific actions necessary for addressing the special challenges faced by SIDS. The priority areas are:

1. Climate change and sea- level rise
2. Man-made and environmental disasters
3. Management of wastes
4. Coastal and marine resources
5. Freshwater resources
6. Groundwater resources
7. Energy resources
8. Tourism resources

9. Biodiversity resources
10. National institutions and administrative capacity
11. Regional institutions and technical cooperation
12. Transport and communication
13. Science and technology
14. Human resource development

The BPOA further identified cross-sectoral areas requiring attention: capacity building; institutional development at the national, regional and international levels; cooperation in the transfer of environmentally sound technologies; trade and economic diversification; and finance. The comprehensive structure of the BPOA elaborates principles and sets out specific strategies at national, regional and international levels over the short, medium and long terms in support of the sustainability of SIDS. The BPOA also highlights the special challenges and constraints that cause major setbacks to the socio-economic development of SIDS, some of which had already been addressed in Agenda 21, including small size and geographic isolation that prevent economies of scale. In addition, the BPOA underscores SIDS' excessive dependence on international trade; high population densities, which increases the pressure on already limited resources; overuse of resources and premature depletion; relatively small watersheds and threatened supplies of fresh water; costly public administration and infrastructure; and limited institutional capacities and domestic markets.

### 3.1.7 The Johannesburg Declaration and Plan of Implementation

This was adopted in Johannesburg at the 2002 World Summit on Sustainable Development. The Johannesburg Declaration and Plan of Implementation (JPOI) includes provisions covering a set of activities and measures that largely focus on the environmental sphere of development. Such activities and measures sought to focus on the world's attention and direct action toward meeting difficult challenges. These include but are not limited to improving people's lives and conserving our natural resources amidst a rising global population, with ever-increasing demands for food, water, shelter, sanitation, energy, health services, and economic security.

### 3.1.8 The Mauritius Strategy for Implementation

The Mauritius Strategy of Implementation (MSI) was adopted in January 2005 under the United Nations General Secretary Resolution (A/57/262). The strategy sets forth actions and strategies in 19 priority areas, which build on the original 14 thematic areas of the Barbados Plan of Action (BPOA). New additional thematic areas in the MSI include graduation from least developed country status, trade, sustainable production and consumption (as called for by the JPOI), health, knowledge management, and culture - all of which are intended to support SIDS in achieving internationally agreed targets and goals, such as the Millennium Development Goals (MDGs). In line with the MDGs, the MSI framework puts in place measures to build resilience within Small Island Developing States.

## 3.2 Regional Framework

This section provides an overview of regional frameworks that facilitate disaster risk reduction efforts across the Caribbean Archipelago.

### 3.2.1 The Caribbean Disaster Emergency Management Agency Agreement

In 1991, Caribbean countries established the Caribbean Disaster Emergency Response Agency. This entity was charged with the responsibility for coordinating emergency response and relief efforts to Participating States<sup>173</sup>. In 2009, the organisation underwent a name change to become the Caribbean Disaster Emergency Management Agency (CDEMA). This action acknowledges the comprehensive approach of the Agency as disaster management underwent a paradigm shift from response-centric to comprehensive. As a CDEMA Participating State, Barbados has committed to comprehensive disaster management. In 2014, Barbados adopted the Regional Comprehensive Disaster Management Strategy and Results Framework (2014-2024) which is aligned to the Sendai Framework for Disaster Risk Reduction. CDEMA has also produced Contingency Plans which outline immediate and coordinated response mechanisms at the regional level, in response to hazard events affecting its Participating States.

<sup>173</sup> This is currently comprised of nineteen (19) Participating States (PS): Anguilla, Antigua and Barbuda, Cayman Islands, Commonwealth of the Bahamas, Barbados, Belize, Commonwealth of Dominica, Grenada, Republic of Guyana, Haiti, Jamaica, Montserrat, St. Kitts & Nevis, Saint Lucia, St. Vincent & the Grenadines, Suriname, Republic of Trinidad & Tobago, Turks & Caicos Islands and the Virgin Islands.

The Comprehensive Disaster Management Strategy and Programming Framework (2014-2024) aims to enable safe and resilient CDEMA Participating States through comprehensive disaster management. It also prescribes a Comprehensive Disaster Management blueprint that provides a conceptual framework to facilitate comprehensive disaster management implementation at the national level and to achieve the desired state for Participating states in the future. The blueprint illustrates the standard for comprehensive disaster management implementation through the development of an effective enabling environment, governance structures, strengthened National Disaster Offices, capacities, frameworks, core functional areas and competencies.

### 3.2.2 The Caribbean Resilience Framework

Members of the Caribbean Community (CARICOM) adopted the Caribbean Resilience Framework in 2018. Aligned to the CDEMA's Comprehensive Disaster Management Strategy, the framework establishes five pillars of resilience that must be addressed to reduce vulnerability to hazard impacts:

- i. Social Protection for the Marginal and Most Vulnerable
- ii. Enhancing Economic Opportunity
- iii. Safeguarding Infrastructure
- iv. Environmental Protection
- v. Operational Readiness and Recovery

### 3.2.3 The Caribbean Public Health Agency

In 2011, CARICOM Member States (of which Barbados belongs), signed the Inter-Governmental Agreement that established the Caribbean Public Health Agency (CARPHA). In so doing, member countries committed to the establishment of a regional umbrella agency that inter alia promotes and develops measures geared towards disease prevention across the Caribbean and supports the Caribbean Community in preparing for and responding to public health emergencies. Under the agreement, Ministers of Health from all member countries that form the Council<sup>174</sup>, commit to promoting policies and programmes to protect health

<sup>174</sup> Member countries include Anguilla, Antigua and Barbuda, Aruba, Bahamas, Barbados, Belize, Bermuda, BES Islands: Bonaire, St. Eustatius and Saba, British Virgin Islands, Cayman Islands, Curacao, Dominica, Grenada, Guyana, Haiti, Jamaica, Montserrat, Saint Kitts and Nevis, Saint Lucia, Sint Maarten, Saint Vincent and the Grenadines, Suriname, Trinidad and Tobago and Turks and Caicos Islands.

and prevent disease, including the implementation of improved public health infrastructure.

### 3.2.4 The Caribbean Agricultural Research and Development Institute

Agriculture is one of the key drivers to achieving economic prosperity, food and nutrition security and rural development in the Caribbean. But the growth of the sector is persistently slow and uneven. In light of such, the Caribbean Agricultural Research and Development Institute (CARDI) was established in 1974 by the government of twelve (12) CARICOM Member States. This institute is dedicated to conducting research on animal and crop production and supporting an improvement in the competitiveness and sustainability of the regional agricultural sector. The institute also provides technical assistance to farmers and government agencies. In its 2018-2022 Strategic Plan, CARDI outlines its five-year programme to build a modernised, productive, and resilient regional agricultural sector. The headquarters of the institute are based in Trinidad and Tobago with country offices located in several Caribbean territories<sup>175</sup>.

### 3.2.5 The Caribbean Community Climate Change

Officially opened in August 2005, the Caribbean Community Climate Change Centre represents a regional arm of the Green Climate Fund. The centre coordinates the Caribbean region's response to climate change and works on effective solutions and projects to combat the environmental impacts of climate change and global warming. The Centre also acts as a repository and clearing house for regional climate change information and data and provides climate change-related policy advice and guidelines to the CARICOM Member States via the CARICOM Secretariat and to the Caribbean Overseas Territories of the United Kingdom. The Centre has been recognised by the United Nations Framework Convention on Climate Change (UNFCCC), the United Nations Environment Programme (UNEP), and other international agencies as the focal point for climate change issues in the Caribbean. It has also been recognised by the United Nations Institute for Training and Research (UNITAR) as a Centre of Excellence

<sup>175</sup> Country offices exist in Antigua & Barbuda, the Bahamas, Barbados, Belize, Cayman Islands, Dominica, Grenada, Guyana, Jamaica, St. Kitts & Nevis, St. Lucia, St. Vincent & the Grenadines, Montserrat, St. Kitts and Nevis, St. Lucia, St. Vincent and the Grenadines as well as Trinidad & Tobago.

### 3.3 National Framework

This section provides an overview of the current Institutional and Political Frameworks that facilitate disaster risk reduction efforts at the national level. Since the achievement of independence, the island of Barbados has embarked upon various measures to ensure social, economic and environmental protection. These consist of national, sectoral and resource management policies and/or initiatives.

#### 3.3.1 Overarching Policies

The following national policy instruments have been formulated to facilitate sustainable development efforts and to support natural capital management:

- The National Strategic Plan
- The Medium-Term Growth and Development Strategy
- The Physical Development Plan
- The Barbados Roofs to Reefs Programme
- The Barbados Comprehensive Disaster Management (CDM) Policy (2022)
- The Draft National Climate Change Policy Framework
- The Updated Barbados Integrated Coastal Zone Management Plan (2020-2030)
- The Disaster Social Relief Plan
- The 2008 Throne Speech
- The Barbados Sustainable Development Policy

##### 3.3.1.1 The National Strategic Plan of Barbados

The National Strategic Plan (NSP) of Barbados 2006-2025 represents the urgency of the Barbadian government to respond to rapid changes at regional and international levels in a more dynamic way. The underlying concept of the policy: "Global Excellence, Barbadian traditions"; provides the blueprint for the realization of Barbados' vision of becoming a fully developed society that is prosperous, socially just and globally competitive by the end of the first quarter of this century. The approach seeks to encourage consultation and input for the private sector, trade unions, non-governmental organisations, and academia. The NSP represents the overarching goal for the future sustainability of the Barbadian economy. The plan encompasses six goals and is based upon the development and integration of Sectoral Strategic Plans which have been already formulated. advocates for the building of a green economy. It thereby highlights the importance of achieving a nexus between the economy, the society and the environment - particularly as it relates to water, food and energy securities, the

built environment and transportation. Objectives associated with the achievement of this goal are:

- To promote and facilitate the sustainable use of our renewable resources and the wise management of our non-renewable natural resources;
- To maintain a safe and reliable water supply;
- To ensure an efficient and reliable energy sector;
- To develop an efficient transport system and infrastructure;
- To improve disaster management; and
- To develop and maintain an efficient land-use policy.

It is anticipated that the National Strategic approach will facilitate the incorporation of social, economic and environmental issues into national development planning.

##### 3.3.1.2 The Medium-Term Growth and Development Strategy

The 2013-2020<sup>176</sup> Medium Term Growth Development Strategy (MTDS) for Barbados<sup>177</sup> articulates the broad national vision:

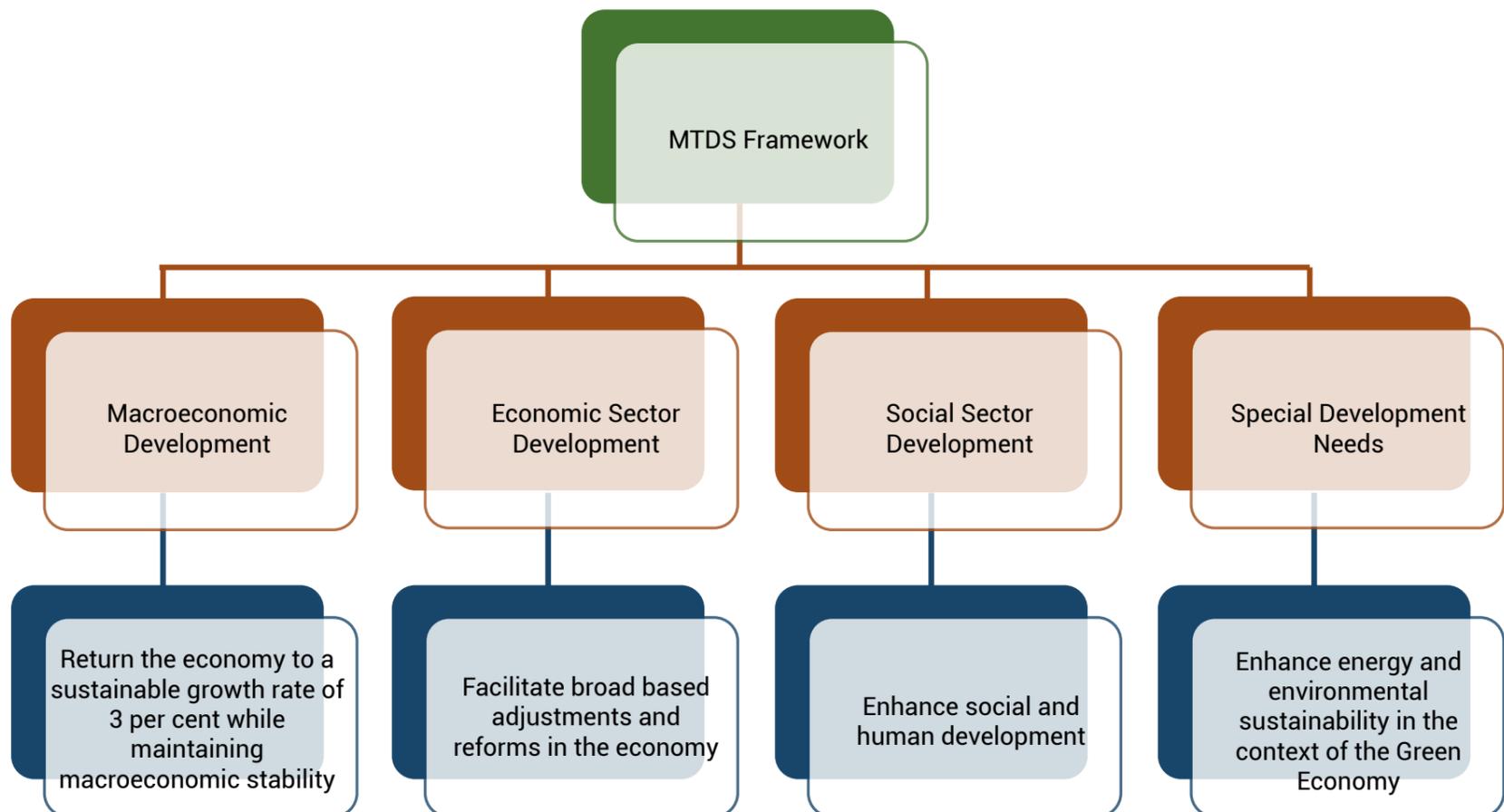
*"To jumpstart and to sustain private sector and investment led; to promote greater productivity and export driven growth based on an environmentally green and socially sustainable and equitable economy while radically adjusting and reforming the Barbadian economy".*

This strategic vision outlines the development of a MTDS framework (as seen in Figure 44). It is comprised of four (4) goals and twenty (20) objectives in support of climate resilient development.

<sup>176</sup> The Government of Barbados. 2013 "The Barbados Medium Term Growth and Development Strategy (2013 – 2020): Recovery, Adjustment and Sustainable Development". <https://caribbean.eclac.org/publications/barbados-growth-and-development-strategy-2013-2020>

<sup>177</sup> The Medium Term Growth and Development Strategy for Barbados (2020-2027) is currently being finalized.

Figure 44: An outline of the MTDS Framework



Source: The Barbados Medium Term Growth and Development Strategy (2013 – 2020)

The objectives outlined under the 2013-2020 Medium Term Growth Development Strategy are depicted in Figure 45. The strategic vision of the MTDS also recognises and supports the country's long-term goal of becoming 'a Fully Developed and People-centred Society, through New Development Pathways'. In terms of economic and social development, special attention has been placed on the government's plans with respect to tourism, agriculture, construction, transportation and health. In addition to this, cross-cutting areas such as energy, water and waste have also been analysed.

Figure 45: Goals under the Barbados Medium Term Growth and Development Strategy



Source: The Barbados Medium Term Growth and Development Strategy (2013-2020)

### 3.3.1.3 The Physical Development Plan

The Physical Development Plan (PDP) for Barbados represents a firm commitment by government to address land usage within this densely populated society. Originally drafted by the GoB in 1970, the document underwent a series of amendments in 1998, 2003, 2017 and more recently in 2021 in light of government's renewed commitment to achieve sustainable development on the island. The newly drafted document<sup>178</sup> is intended to provide a vision for the future growth and development of the nation by setting out policies which guide the relationships among land uses, community facilities and physical infrastructure. The main purpose of a PDP is to foster the economic, environmental, physical, and social well-being of the residents of Barbados and to establish a vision to guide the future form of development with respect to land use and environmental management. As seen in Figure 46, the PDP seeks to address developmental issues which impact the following sectors and cross-cutting areas:

Figure 46: Priority Sectors and Cross Cutting Areas under the Physical Development Plan



Source: The Physical Development Plan for Barbados

The concept of sustainable development has been ingrained in the underlying principles of the PDP. This is noted by the policy's commitment to:

- Foster the economic, environmental, physical and social well-being of the residents of Barbados;
- Address the critical impacts of climate change on Barbados as a Small Island Developing State (SIDS) through policies and strategies that enable the people of Barbados to thrive and remain resilient under changing climatic conditions;
- Establish a vision to guide the future form of development with respect to land use, settlement patterns, food production, infrastructure and environmental management;
- Guide the future form of development on the island and inform the public, business and government sectors as to the nature, scope and location of both development and protection areas for core assets; and
- Provide a clear and accessible investment framework for private and public works and actions which impact the social, economic and environmental health of the nation.

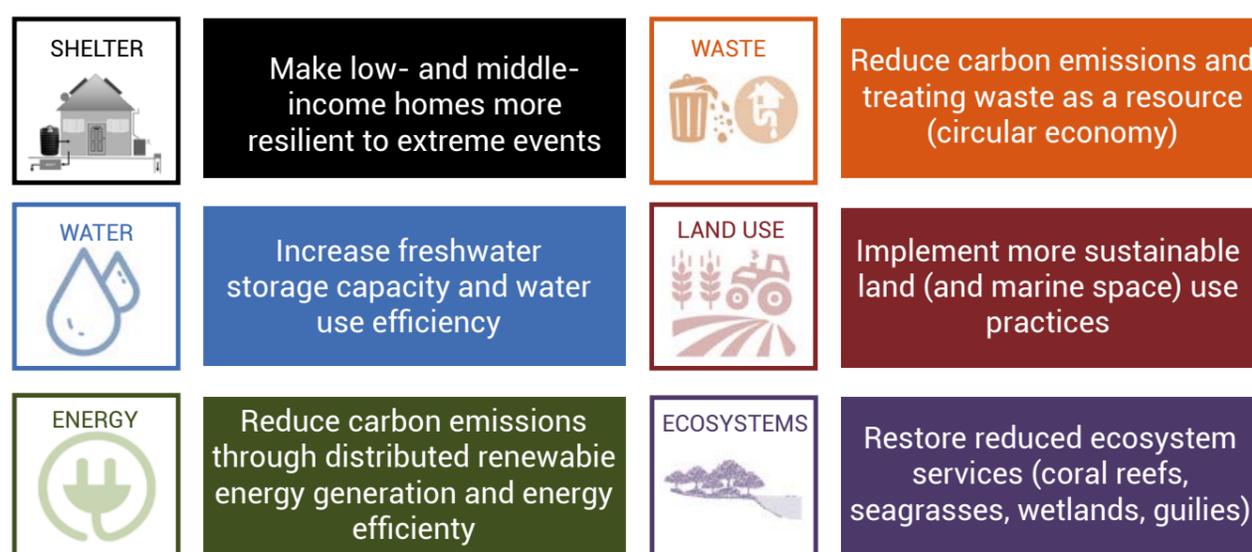
The relationship between land use, land development and society has an extremely important role to play in the advancement of the country. Without the well laid out structure and forward thinking of the PDP, there would be constant chaos between various sectors which all vie for land-based resources. Therefore the PDP promotes the Green Economy through its ability to aid in policy decisions that offer sound developmental planning for the country. This in turn offers long term beneficial outcomes for future generations through environmental and habitat protection and preservation; security of agricultural lands; clean water preservation; and sound structural practices. A geographical depiction of the Physical Development Plan for Barbados can be seen in Appendix XII.

<sup>178</sup> The Amended Draft of the Physical Development Plan for Barbados is still yet to be approved. The PDP is intended to provide a vision for sustainable growth and development of the nation by setting out policies to guide relationships among land uses, built form, mobility, community facilities and physical infrastructure. It is also intended to be a framework to facilitate and guide public and private investment in Barbados by the year 2035 to advance a healthy, prosperous and resilient nation.

### 3.3.1.4 The Barbados Roofs to Reefs Programme

Through its newly developed National Adaptation Plan called the Barbados Roofs to Reefs Programme (R2RP), the GoB has spearheaded efforts to promote island-wide resilience to hazards and disasters. The R2RP, which represents a holistic initiative, seeks to integrate mitigation and adaptation climate concerns with a social policy geared towards improving the standard of living and quality of life for all - particularly the most vulnerable segments of the Barbadian population of Barbados. The objectives<sup>179</sup> of the Barbados' R2RP are depicted in Figure 47.

Figure 47: The Objectives of the Barbados Roofs to Reefs Programme (R2RP)



Source: The Ministry of Environment and Natural Beautification, 2022

As the operational arm of the Barbados' Physical Development Plan, the R2RP facilitates the avenue through which public investment will be directed. With a strong participation by the Ministry for Economic Affairs and Investment, the R2RP aims to improve the resilience of the housing stock and access to water and sanitation while eradicating pit toilets and promoting the use of solar and other green energy options to reduce dependence on fossil fuels. It also seeks to address direct line electricity transmission, improve water quality, and reduce the volumes and impacts of waste (both solid and liquid). These efforts are expected to lead to better living conditions and terrestrial and marine environments, including gullies and coral reefs.

To create an enabling environment to achieve the R2RP agenda, a range of regulatory provisions need to be either created or amended. Under the R2RP, the Urban Development Commission (UDC) and the Rural Development Commission (RDC) will carry out a retrofitting program for vulnerable homes, including the replacement of pit latrines. The UDC and RDC are expected to execute the projects in accordance with recognized international and national standards covering such technical aspects as roof pitch and foundation type to ensure greater resilience of housing projects against hurricanes. New constructions as well as retrofitting and reinforcing existing structures in this manner would minimize the risks of overturning, uplifting, or sliding due to strong winds or water currents (IDB, 2021).

#### Box 4 - The R2RP: Increasing Resilience with Five Types of Interventions

Under the R2RP, building resilience in the low and middle-income housing stock will include: (i) fortifying the roofs, windows, and doors of buildings, including low- and middle-income housing, to withstand up to Category 4 hurricane wind speeds (157 mph); (ii) furnishing grid-tied rooftop solar photovoltaic systems (with battery storage in the event of grid loss). Installation will be conducted under a to-be-established protocol/code to reduce the risk of losing the panels in an extreme wind event; (iii) installing modern rooftop rainwater harvesting systems and stormwater drainage to improve both water storage capacity and groundwater recharge rates; (iv) providing potable water storage systems to increase resilience to drinking water shortages; and (v) building modern, cost-effective, affordable household or communal waste-water treatment systems, with particular emphasis on nutrient removal/recovery (closing the nitrogen loop) to protect vital coastal reefs. To apply these measures consistently, a policy to retrofit and build up the resilience of low- and middle-income structures is needed in the medium term, as are guidelines to construct new climate resilient housing for these segments of the population.

Source: The 2021 IDB Report on Climate Policies in Latin America and the Caribbean

<sup>179</sup> It should be noted that although interventions may be packaged as projects, the programmatic approach provides coordination and coherence.

### 3.3.1.5 The Barbados Comprehensive Disaster Management (CDM) Policy (2022)

In 2003, the GoB adopted the Comprehensive Disaster Management (CDM) mandate. While it encompasses the management of all hazards throughout all phases of the disaster management cycle (prevention and mitigation, preparedness, response, recovery and rehabilitation), the CDM mandate also factors in all segments of society: the public and private sectors, civil society and the general population within hazard prone areas. The CDM mandate also involves “risk reduction, risk management and the integration of vulnerability assessments into the development planning process” (CDERA 2001; CDERA 2006). The impetus for this paradigm shift from a primary focus on preparedness and response efforts to all phases of the disaster management cycle was driven by international and regional disaster risk reduction strategies (specifically in 2005 and 2001 respectively) that were catalysed by the International Decade for Natural Disaster Reduction in the 1990s.

The overarching aim of the CDM is to reduce losses and damages and to promote resilient and safer societies through the engagement of all people, sectors, and the society. To facilitate the implementation of the broad CDM mandate at the national level, the GoB established the Emergency Management Act Cap. 160A (2007). This act supports the transition from the Central Emergency Response Organisation (CERO) - a relief organisation to the Department of Emergency Management (DEM) - a disaster management organisation which is responsible for upholding the broad CDM mandate at the national level. Solidifying Barbados' pathway towards disaster resilience requires a demonstrated level of commitment to international as well as regional initiatives and objectives. These include the regional CDM Strategy and Results Framework (2014-2024); the CARICOM Strategic Plan; the 2030 Agenda for Sustainable Development that outlines the Sustainable Development Goals; the Sendai Framework for Disaster Risk Reduction (SFDRR) 2015-2030; and the 2015 Paris Agreement.

In October 2022, the GoB adopted the Barbados Comprehensive Disaster Management (CDM) Policy (2022). This action represents the government's high degree of political will and transformational thinking to ensure citizen security. The policy outlines the national strategic mission to keep individuals safe and to make communities more resilient to disaster

and climate-related risks and impacts. The mission statement of the Barbados CDM Policy (2022) can be seen in Box 5.

#### Box 5: Mission Statement of the Barbados Comprehensive Disaster Management (CDM) Policy (2022)

To provide the supportive governance and accountability arrangements to guide the development and mainstreaming of CDM policies and programs by all Ministries, Departments, statutory bodies, community-based organisations, private sector entities, non-governmental organizations, faith-based organizations, communities and individuals, for reduced losses and damages, safer communities, more resilient people, a protected environment, a stable society, and sustainable economy.

### 3.3.1.6 The Draft National Climate Change Policy Framework

To highlight its commitment to address climate change adaptation and mitigation at the national level whilst adhering to regional and international frameworks, the GoB has drafted the National Climate Change Policy<sup>180</sup>. The primary goal of the policy is to “establish a national process for adapting to climate change effects and minimising greenhouse gas emissions over the short, medium and long term, and to do this in a manner that is coordinated and consistent with the broader sustainable development aspiration,” (GoB, 2018). This National Policy Draft seeks to fulfil the following objectives:

- Establish an appropriate mechanism for responding to challenges related to climate change;
- Engage in regional and international climate change negotiations, planning and response mechanisms;
- Effect full stakeholder engagement in the development and execution of domestic climate change mitigation and adaptation actions; and
- Conduct climate change research.

<sup>180</sup> The Government of Barbados. 2018. “The Barbados' Second National Communications to the UNFCCC”.

The Draft National Climate Change Policy Framework is monitored by the National Climate Change Committee (NCCC)<sup>181</sup> (as seen in Figure 48) and chaired by the Ministry of Environment and Natural Beautification<sup>182</sup>. By becoming a signatory to the Paris Agreement in April 2016, the GoB reaffirmed its commitment to build resilience to climate change not only across the natural biomes but also within the built environment. Through the NCCC, consultations on medium to long term planning against current and future contributions to the Paris Agreement have commenced including the identification of supporting Implementation strategies.

**Figure 48: The National Climate Change Committee**



Source: Government of Barbados, 2018

181 A committee is comprised of representatives from various government ministries, non-governmental organizations and the private sector.

182 The Chair of the Committee may co-opt other members as deemed appropriate.

### 3.3.1.6 The Updated Barbados Integrated Coastal Zone Management Plan (2020-2030)

Originally drafted in 1998, the amended version of the Integrated Coastal Zone Management (ICZM) Plan seeks to provide detailed guidance on the management of coastal resources. It includes regulations regarding the use and development of the coastline that embraces current and future climate and disaster risks. The ICZM Plan is presented in two distinct volumes: (i) Volume 1: ICZM – The Barbados Policy Framework that describes ICZM policy outcomes and goals; and (ii) Volume 2: ICZM – The Barbados ICZM Plan. These volumes provide detailed guidance on general themes relevant for activities within the Coastal Zone Management Area<sup>183</sup> (CZMA) at the national and sub-area levels<sup>184</sup>. Such guidance offers support and advise on how all sectors and the Barbadian society can achieve climate resilient development. Primary legislations relevant to the ICZM include:

- Proposed revisions to the CZM Act (2020) to help update and supersede the existing CZM Act (Cap. 394A 1998);
- The Planning and Development Act (2019);
- The Marine Pollution Control Act (1998);
- The Fisheries Act (Cap. 391) 1995;
- The Barbados Territorial Waters Act (Cap. 386) 2002;
- The Marine Areas (Preservation and Enhancement) (Barbados Marine Reserve Regulations) 1981; and
- Other provisions within the current Coastal Zone Management Act that currently pertain to management of restricted areas by the National Conservation Commission

<sup>183</sup> The CZMA constitutes the geographic limits of this ICZM Plan, updating the inland and offshore limits originally established within 1998 ICZM Plans for the Atlantic and Caribbean Seas (Halcrow 1998). The delineation of the CZMA of Barbados is based on a sound technical and scientific analysis of the coastal zone.

<sup>184</sup> The CZMA is divided into a series of "Sub Areas", as originally defined within the 1998 ICZM Plan, that reflect specific Barbadian coastal characteristics and risk exposure variances. These were based on the legal and administrative framework, physical (mainly coastal geology), geomorphological and human (mainly land use patterns) characteristics. They continue to embrace these criteria set in 1998, but importantly, they have now been updated to better reflect the improved understanding of coastal hazards, vulnerabilities and climate/disaster risks that have more recently been studied, monitored and witnessed since 1998 to the present day.

(NCC) of the Ministry of the Environment and National Beautification (MENB).

### 3.3.1.7 The Disaster Social Relief Plan

Under the auspices of the Ministry of People Empowerment and Elder Affairs (MPEA), the Disaster Social Relief Plan (DSRP) make provisions individuals who require food, clothing or compensation in the aftermath of an emergency. Relief services detailed within the plan may be required in the aftermath of incidents of limited scale as well as major emergencies or disasters. Several government agencies are assigned to provide Disaster Social Relief services as part of the national response and recovery mechanism. These include:

- The Ministry of People Empowerment and Elder Affairs (MPEA);
- The Ministry of Education, Technological and Vocational Training (METVT);
- The Ministry of Agriculture and Food Security (MAFS);
- The Ministry of Home Affairs and Information (MHA);
- The Ministry of Housing, Lands, and Rural Development (MHLR); and
- The Urban Development Commission (UDC) under the Prime Minister's Office.

Operationally, the response mechanism is divided into three (3) broad programmes, each geared towards a specific purpose yet simultaneously facilitating a holistic response to disaster relief efforts. These programmes include: Disaster Social Relief; Food and General Supplies; and Housing Repair and Replacement.

The operational arm of the DSRP is the Disaster Social Relief Committee (DSRC)<sup>185</sup> which was established to develop and review policies for the management and delivery of social relief. The committee advises on measures and strategies that could be implemented to enhance the public services provided during disasters. The Committee also has oversight for the coordination of disaster social relief activities which include the request for, receipt of and the distribution of supplies and services. The specific objectives of the DSRC are:

<sup>185</sup> The committee is comprised of several entities as seen in Appendix IV.

- To develop a plan that would guide the response to Disaster Social Relief;
- To institute systematic guidelines for responders in delivering effective social services, including food and supplies;
- To provide a coordinated, efficient and effective system of Disaster Social Relief to victims; and
- To ensure the expeditious delivery of goods and services to priority areas based on needs analyses and damage assessment reports.

The functions of the DSRC are:

- To develop a Disaster Social Relief Policy.
- To establish a Disaster Social Relief System.
- To allocate staff to all Disaster Relief Centres.
- To maintain a current listing of needs (technical and human resources).
- To provide training of staff of the relevant responding agencies to allow for efficient execution of the DSRC.
- To coordinate the provision of relief that pertains to social services which also include investigation and follow up of claims made by victims of a disaster:
  - o Shelter, in collaboration with the METVT.
  - o Food and other supplies, including bulk supplies e.g. tents, in collaboration with the FGSC.
  - o General and psychological counselling
  - o Emergency Housing (House Repair/ Replacement) in collaboration with the MHLR and UDC
  - o Information and enquiry.
- To develop, review and update annually the DSRP.
- To liaise with the DEOs and other volunteers in the area of needs assessment at all levels.

- To ensure that the appropriate Agencies and Departments in the sector are in a position to meet the needs of the population before, during and after a disaster.
- To facilitate the general relief and rehabilitation of all disaster victims.

### 3.3.1.8 The 2008 Throne Speech

Within this speech<sup>186</sup>, the GoB reaffirmed its commitment to propel the Barbadian economy forward in the global economic crisis whilst attempting to promote cultural retention and aspire to a higher level of development (that is people oriented, culturally specific and socially rooted on the basic spirituality of our ancestors). The 2008 Throne speech highlighted the following issues that can plague the advancement of the Barbadian economy:

- The cost of living;
- Health care;
- Education;
- Social Security;
- Transportation and Infrastructural Development and
- Land use planning (as it relates to environmental protection and agricultural development)

The latter is of utmost importance when one considers the conservation and preservation of natural ecosystems. Market failure can lead to inefficient and ineffective policy legislations which can place considerable pressures on the agriculture sector and the natural environs. The enhancement of the agricultural sector as it relates to sugar cane production and the fisheries sub sector is vital to the advancement of our small island developing state. It provides a source of revenue for the economy, employment and output for rural communities thereby contributing to rural prosperity and results in sustainable food production. In addition, the viability of the fisheries sub sector is threatened by failed negotiations between territories which share maritime borders. Care must be taken during the development and implementation of such policies so that a win-win solution can be achieved for all parties involved.

<sup>186</sup> "The Speech from the Throne" by His Excellency the Honourable Elliot Belgrave, C.H.B: Acting Governor General of Barbados, February 12th, 2008.

### 3.3.1.9 The Barbados Sustainable Development Policy

The Barbados Sustainable Development Policy (BSDP) was forged out a joint initiative between the Ministry of Environment and the National Commission on Sustainable Development in 2004. The latter institution, which was established in 1994, has been regarded as the most visible and successful structure put in place for the coordination of national sustainable development. The role of the Commission<sup>187</sup> was to:

1. Advise Government on measures required to integrate environmental and economic considerations into the decision-making process and on global issues of sustainable development;
2. Facilitate national level co-ordination mechanisms on sustainable development;
3. Promote greater understanding and public awareness of cultural, social, economic and policy opportunities to attaining sustainable development in Barbados;
4. Receive and review the annual report of actions in pursuit of sustainable development, prior to its submission to Cabinet and to the United Nations Commission on Sustainable Development (UNCSD).

The drafting of the BSDP sought not only to support the previous work done by this commission, but also to outline a revised approach of sustainable development that deals with individual issues from an integrated and holistic perspective. The overarching goal of the BSDP is to *“ensure the optimization of the quality of life for every person by ensuring that economic growth and development does not occur to the detriment of our ecological capital.”* The major objectives of the policy were:

1. To formulate a national definition of sustainable development;

2. To provide a national framework for decision-making based on our principles of sustainable development;
3. To promote principles of sustainable development and encourage all persons to adopt and apply these principles in every aspect of decision-making; and
4. To sensitize and educate all persons in Barbados about key issues and conflicts between development and environment and the need to make wise consumption and production choices.

The policy articulates the founding principles of sustainable development: quality of life; conservation of resources; economic efficiency; equity and participation. It can therefore be viewed as a template for decision makers and citizens because it provides implications for a wide range and diversity of subjects covering the spectrum from environmental protection to public finance.

### 3.3.2 Sectoral Policies

This section provides an overview of the current policy frameworks that facilitate disaster risk reduction efforts at the sectoral level.

#### 3.3.2.1 Health

The Ministry of Health and Wellness is the government entity responsible promoting and managing the health of the Barbadian populace through the provision of high-quality trained personnel and effective management of the health services. The overarching objectives for the health sector are retained within Goal 3: Building Social Capital of the Barbados National Strategic Plan (2006-2025) and are associated with the following national targets as it relates to CCA and DRM:

- Objective 1.2: Increase in the average life expectancy rate for both males and females;
- Objective 1.3: Substantially reduce the incidence of communicable and noncommunicable diseases by 2025; and
- Objective 1.6: Achieve a top-ten ranking in the United Nations Human Development Index by 2025

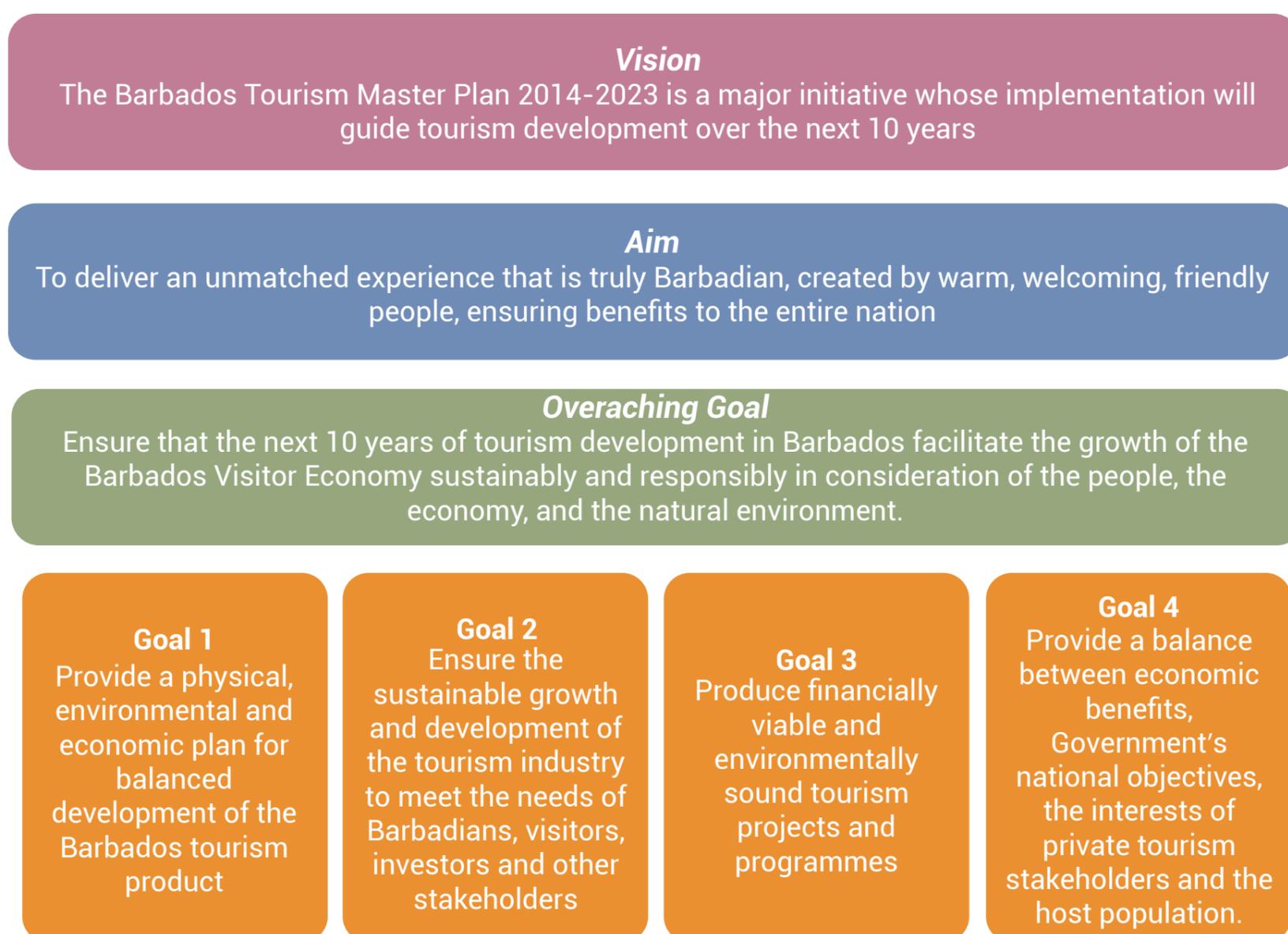
<sup>187</sup> Excerpt from Page 12 of the 2010 Barbados National Assessment Report of Progress made in addressing Vulnerabilities of SIDS through Implementation of the Mauritius Strategy for Further Implementation (MSI) of the Barbados Programme of Action, Ministry of Energy, Water Resources and Drainage, Government of Barbados, 2010

### 3.3.2.2 Tourism

The Tourism industry is the principal earner of foreign exchange for the Barbadian economy. As it is inextricably linked to other sectors within the economy, care must be taken to ensure that the 'tourism product' is of the highest quality so that leads to overall economic advancement. The government has sought to adopt the following strategies to ensure such:

- Develop a Tourism Master Plan (as seen in Figure 49) that will enable government, along with other agencies, to make adequate provision for tourism development in a holistic manner so that it addresses the needs of Barbadian residents and visitors, while at the same time protecting and improving the opportunities available to future generations;
- Host public stakeholder consultations in conjunction with other public and private sector organisations in the industry, to examine the issues and challenges which affect the industry and conduct the research necessary to guide the sector and keep it on a sustained growth path;
- Conduct tourism awareness surveys to assess the general public's awareness of the local tourism industry; and
- Collaborate with national, regional and international agencies to develop a system which accurately estimates the contribution of tourism to the Barbadian economy.

Figure 49: An Overview of the Tourism Master Plan



Source: The Barbados Tourism Master Plan (2014-2023)

The overall sustainability of the tourism product has come into question because many past practices of local tourism stakeholders were neither economically, environmentally nor socially sustainable. As a result, it is imperative that such practices must be modified in order to achieve sustainable tourism. Fulfilling the aim, overarching goal and objectives of the Tourism Master Plan therefore requires a highly participatory approach in order to:

- Base decisions on comprehensive, accurate, and timely data/information
- Enhance the visitor experience
  - Niche markets; Built heritage; Cultural heritage; Natural heritage
- Change the tourism mindset
- Develop airlift capacity
- Improve financial performance
- Modernize accommodation and improve the performance of the sector
- Enhance the cruise tourism product and experiences
- Improve the transportation of people on land and near shore
- Assure safety and security of visitors and residents
- Effectively market Barbados
- Mainstream environmental management
- Update and enforce policy and legislation to support the Barbados Visitor Economy (BVE)

### 3.3.2.3 Agriculture

Like most developing nations, Barbados is a net importing country. A recent call from the government sought to increase domestic food production via new and improved agricultural techniques. The overall aim of this initiative is to sustainably reduce the importation of food. Productivity within the sector is lowered by the degradation, desertification, salinization and contamination of land, the contamination of water resources and

by the increasing prevalence of crop shortages<sup>188</sup>. In addition, exogenous shocks include high global energy costs and rapid climate change, the latter of which could substantially increase the frequency and intensity of natural phenomena. In an attempt to address these issues, the government has sought to adopt the following measures:

- Support the introduction of new technologies;
- Contribute to food and nutrition security of the nation through the production of nutritious food at reasonable prices and on a consistent basis;
- Protect and reduce the risk to agricultural health and facilitate food safety through the provision of the requisite infrastructure and services for testing, monitoring, inspection, as well as the attainment of certain minimum standards, for the country's animal, plant and fish stocks;
- Enhance the competitiveness and productivity of the agricultural sector to better enable it to compete in both the domestic, as well as the international markets, and to increase output;
- Promote sustainable agricultural development;
- Ensure the sustainable availability and production of fish and fish products by assuring the efficient management and development of the fisheries resources;
- Facilitate an enhanced level of participation in agricultural production, by providing access to critical means of production e.g., land, water, capital and inputs;
- Develop strong, vibrant rural communities; and
- Enhance the capacity of the sector to assist in transforming and repositioning the sector, through the provision of the requisite enabling environment, including the creation of the appropriate legislative framework.

<sup>188</sup> The United Nations Economic and Social Council. "Agriculture, rural development, land, drought and desertification: obstacles, lessons and challenges for the sustainable development of Latin America and the Caribbean." E/CN.17/2008/12/Add.3\*. The United Nations Commission on Sustainable Development, 10 April 2008. p.3

### 3.3.2.4 Construction

Over the years, the construction industry has been a major contributor to GDP. Even though it has not been enacted, the major instrument that governs the building and construction sector is the 1993 edition of the Building Act. The Act, which is currently under review by the Chief Parliamentary Council, after being reviewed by the Building Advisory Committee, seeks to establish technical standards for building to ensure a safe and healthy environment for occupants. In addition, it seeks to provide the legislative framework for the establishment and operation of the Barbados Building Standards Authority and the mandatory use of the Barbados National Building Code.

### 3.3.2.5 Housing

The Barbadian landscape has undergone significant demographic changes from a plantation economy to a more upscale urban society. As the society enjoys a high standard of living noted by its high Human Development Index, there is an ever-increasing demand for housing. In this regard, the GoB has devised several strategies. These following strategies seek to provide adequate shelter for all and to create home ownership for the majority of the population by providing the opportunity for the widest majority of Barbadians to own property:

- 500 Lot Programme
- H.E.L.P (Housing Every Last Person)
- Rent to Own Programme
- Zero Lot Line Concept
- Transfer of Terrace Units
- Low and Middle Income Housing
- Housing Solutions
- Assisting the needy
- Starter Homes

### 3.3.2.6 Transportation

In an effort to improve the island's transportation network system, the Ministry of Transport has sought to embark upon the following initiatives:

- To re-examine the feasibility of the construction of footbridges along the ABC Highway.
- To continue to carry out improvements to dangerous junctions to enhance visibility thereby eliminating accidents and possible fatalities;

- To undertake traffic experiments in traffic design aimed at enhancing flows in specific areas;
- To complete the feasibility study of the extension to the Ernie Bourne Highway;
- To encourage the use of low emission vehicles by using emission test metres on vehicles which are being inspected as well as on the road;
- To continue the process of establishing the Barbados Building Standards Authority;
- To continue with the development of Permanent Park and Ride Facilities; and
- To promote the uptake of electric vehicles

### 3.3.2.7 Environment

Care for the environment has always been a priority for the GoB. There are several policy frameworks that facilitate disaster risk reduction efforts across various natural resources. For instance, the 2013-2020 MTDS Framework emphasizes the importance of Special Development Needs in an effort to enhance energy and environmental sustainability in the context of the Green Economy. The MTDS Framework has therefore outlined strategies to:

- Improve the standard of living of all citizens;
- Conserve its natural resources noting the high vulnerability of the island to natural and man-made disasters;
- Promote economic efficiency by employing strategies outlined in the National Strategic Plan (NSP) 2006-2025;
- Facilitate enhanced participation of the private sector as well as key players in the environmental industry to disseminate public awareness of the link between the environment, quality of life and sustainable development, particularly at the primary and secondary levels of education;
- Facilitate enhanced participation of non-governmental organizations (NGOs), industry, developers, and community based organizations (CBOs) in the overall management of Barbados' environmental

and natural resources assets in partnership with the Government; and

- Ensure sound development of the betterment of all sectors through the existence of a multi-sectoral environmental regulatory system.
- Other national reports have highlighted groundbreaking research and governmental and sectoral responses to issues relating to the three (3) cross-cutting areas of energy, water and waste.

### Cross-Cutting Area 1: Energy

The Barbados National Energy Policy is based upon a framework that encompasses internationally protocols such as those undertaken by the United Nations Framework Convention on Climate Change. Its primary goal is to contribute towards the achievement of sustainable development. The goals, objectives and strategies outlined in the NEP are part of the vision to transition Barbados to a fully developed country by 2025 and to reduce its dependency on fossil fuels. The policy identifies the following issues as being critical to a vibrant and sustainable energy sector:

- Policy Issue 1: Ensuring security and stability of supply;
- Policy Issue 2: Maximising energy efficiency;
- Policy Issue 3: Creating a competitive market;
- Policy Issue 4: Achieving environmental sustainability; and
- Policy Issue 5: Ensuring timely and effective implementation.

The main goal of the Barbados National Energy Policy (BNEP) 2019-2030 is to ensure 'Energy security and affordability through diversity and collaboration: Establishing and maintaining a sustainable energy sector for Barbados'. The policy, which has the potential to significantly impact the physical environment of the Barbadian landscape, was based upon the underlying principles of the Barbados Sustainable Development Policy: quality of life, conservation of resources, economic efficiency, equity and participation. The policy outlines the following renewable energy targets:

- 34% increase in renewable energy and bridging fossil fuels (BFFs)<sup>189</sup> by 2022
- 50% increase in renewable energy and BFFs by 2027
- 56% increase in renewable energy and BFFs by 2032
- 75% increase in renewable energy and BFFs by 2037

Despite the dependence on imported fossil fuels, Barbados has made tremendous strides in incorporating more renewable energy into the national energy mix. Perhaps the most touted illustration of this transition is the solar water heating industry. Within a single year, the industry was estimated to save the island 15,000 metric tons of carbon emissions and over US\$100 million in imported fossil fuels<sup>190</sup>. More than 70% of households on the island have some type of solar hot water heating system installed and many businesses, particularly in tourism, also utilise these systems. The relatively high penetration rate of solar powered hot water systems has been supported by a US\$5,000 per year tax allowance, which allows Barbadian households to write off the cost of purchasing these systems.

### Cross-Cutting Area 2: Water

Barbados has been previously ranked as the 15<sup>th</sup> most water scarce countries<sup>191</sup> in the world<sup>192</sup>. Therefore the protection, efficient use and consumption of our water supply is of the utmost importance to the survival of the country's continual economic development. However, through development, the potable water supply is strained by rapid infrastructural growth due to urban development. There is increased water usage during the building phase, then during the operational phase, and

<sup>189</sup> The targets are expressed in terms of renewable energy and BFFs to account for the possibility of natural gas derived from fossil fuels in the mix.

<sup>190</sup> See <http://www.unep.org/greeneconomy/SuccessStories/SolarEnergyinBarbados/tabid/29891/Default.aspx> for further details.

<sup>191</sup> According to the Water Security Risk Index 2010, prepared by Maplecroft (a firm which specializes in corporate risk management, Barbados is preceded by countries in the Middle East and North Africa (MENA) region. The top ten (10) countries with the least secure supplies of water at the time include: Somalia, Mauritania, Sudan, Niger, Iraq, Uzbekistan, Pakistan, Egypt, Turkmenistan and Syria. The ranking was based on three factors: access to water, water demands and reliance of external supplies. <https://www.industryweek.com/finance/article/22010379/maplecrofts-2010-water-security-risk-index-identifies-ten-countries-at-extreme-risk>.

<sup>192</sup> The World Bank. 2022. "Climate Change Knowledge Platform". <https://climateknowledgeportal.worldbank.org/country/barbados/vulnerability>

rainfall runoff may not infiltrate to, and recharge aquifers due to runoff being channeled elsewhere. Less fresh for aquifer recharge along with a growing domestic demand compounds other water management issues such as water contamination and saltwater intrusion. Issues such as these show the importance of sustainable management and allocation of the precious resource. Fresh water supplies in Barbados are protected and managed under the following statutes:

- Three Houses Spring Act, 1713;
- The Porey Springs Act, 1864;
- The Underground Water Authority Act 1953 [Cap. 283]
- The Soil Conservation (Scotland District) Act, 1959;
- The Health Services Act and Regulations (1969);
- The Barbados Water Authority Act, 1980 [Cap.274A]
- The Town and Country Planning Development Order, 1972; and 1985
- The Marine Pollution Act, 1998.

Some policy recommendations that have been included towards the efficient utilization, conservation and protection of fresh water supplies are:

- Obtaining and maintaining up-to-date records of the total available fresh water across the island. This would include all water related data such as total rainfall collection and water extraction;
- The formulation and development of a concise and comprehensive ground water research programme within a tertiary institution;
- Phasing out of the importation of non-water saving equipment and devices;
- The implementation of concessions and incentives to encourage society to practice water conservation measures such as rainwater harvesting;

- Internalization of external environmental costs of fresh water supply;
- Internalization of external social costs of fresh water supply and utilization into the costs of its supply;
- Defining a hierarchy of various sectors when it comes to fresh water supply;
- Conducting research on the effects of climate change on the supply of fresh water due to increased temperatures and reduced rainfall and the mitigation of these effects;
- Exploring the option of wastewater management and reuse through the West coast Sewerage Project; and
- Reduction in unaccounted for water from 60% to 30% by 2016.

One example of a policy that was implemented by the Barbados Water Authority was the mandatory installation of rainwater tanks to new houses that were of a particular size. The Town and Country Development Planning Office oversaw the implementation of this policy. This initiative sought to encourage households to practice efficient water management by utilizing rainwater for non-potable household use.

### **Cross-Cutting Area 3: Waste**

Barbados is a net importing country and therefore has large volume of imported goods. The disposal of these goods is problematic to the environment due to their large numbers. This when pooled with the high population density in a small land area and annual stay-over tourist arrivals that almost double the local resident population at any given time, presents challenges for sound waste management and disposal. Illegal dumping in gullies, on beaches and on vacant lots is also a major problem in solid waste management. Issues such as these are detrimental to the health of citizens and the health and overall look of the environment. There are specific pieces of legislation for different hazardous materials, for example pesticides and explosives, but there is no overarching legislation that addresses all hazardous materials<sup>193</sup>. Various legislations that have been enacted to deal with waste disposal are:

<sup>193</sup> Government of Barbados. 2010. "The Barbados National Assessment Report 2010 - The Ministry of the Environment, Water Resources and Drainage". pp. 108

- The Waste Services Act
- The Health Services (Nuisances) Regulations
- The Health Services (Disposal of Offensive Matter) Regulations
- The Basel Convention on the Control of Transboundary Movements of Hazardous Waste; and
- The Health Sector Development Plan (1993-2000)

Waste can be divided into solid, liquid, air emissions and hazardous waste. Recommendations for the management of these types of waste are:

- Establishment of air quality monitoring programs for both indoors and outdoors;
- Development of air quality standards that protect human health and at least meet the minimum international air quality requirements;
- Implementation of programs and initiatives which comply to Barbados' obligations to international Agreements such as the Vienna Convention on the Ozone Layer;
- The continual development of Barbados' solid waste management programme and the education of the public towards waste awareness;
- Encouragement of private stakeholder involvement in sustainable waste management practices;
- Completion of various sewerage treatment and management projects and the upgrading of the Bridgetown sewerage plant;
- Development of a policy as a guide for the management for all hazardous wastes including agricultural and manufacturing chemicals; and
- The investigation of incidents of groundwater contamination by accidental spills or the disposal of hazardous forms of wastes, and mitigation measures to reduce the likelihood of future incidents.

In recent times, the GoB has implemented projects with a focus on sustainable waste management. For instance, the Solid Waste Management Centre at Vauclose. This represented a joint Public-Private agreement between the government and the Sustainable Barbados Recycling Centre (SBRC). Waste is redirected to the centre instead of going directly to the landfill. It is later sorted and recyclable material is recovered. The centre includes a transfer station, composting facility and chemical waste storage facility<sup>194</sup>. Approximately 70% of the waste is diverted to the centre. The SBRC therefore facilitates the reduction of unnecessary waste that reaches the landfill. Such waste could be otherwise recycled.

### 3.3.3 National Initiatives, Projects and Activities

This section highlights national initiatives, projects and activities related to preservation and conservation of the island's natural resource base and the built environment. Such initiatives include current and proposed measures to maintain biodiversity and minimise disaster risk within various biomes across the island through the application of sound management policies and legislative frameworks. There have also been a series of national projects, workshops and engagements undertaken by the DEM to highlight disaster risk reduction efforts across Barbados in adherence to the Priority Areas to be implemented under the Barbados Comprehensive Disaster Management (CDM) Country Work Programme (CWP) 2019-2023 and to facilitate collaborations at the local, national, regional and international levels. These collective efforts focus on Institutional Strengthening for Comprehensive Disaster Management; Preparedness, Response and Mitigation Capacity Strengthening; Strengthening Community Resilience; Research and Knowledge Management; Recovery; and External Relations. Further details regarding these efforts are outlined in Appendix IX.

#### 3.3.3.1 Biodiversity resources

There is currently no legislation which specifically speaks to the protection of wild flora and fauna. Similarly, there is no broad regulation of the international trade in endangered species as required in international conventions such as the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES). The following initiatives seek to ensure the protection of biodiversity resources:

<sup>194</sup> facility . Approximately

- The Wild Birds Protection Act 1907 (cap. 398) (WBPA)
- The Protection of New Plant Varieties Act (2000-17)
- The National Conservation Commission Act 1982
- The Cultivation of Trees Act (cap.390)
- The Trees (Preservation) Act (cap.397)
- The Draft National Park Development Plan 1998
- The National Biodiversity Strategy and Action Plan 2002

#### **3.3.3.1.1 The Wild Birds Protection Act 1907 (cap. 398) (WBPA)**

Over 40 species of wild birds are protected under this act. People who knowingly kill, wound or attempt to harm these creatures are liable to a fine, half of which is payable to the informant. Moreover, the possession and export of any matter whether it is skin or feathers is also an offense. However, an exception is made for licensed researchers who wish to obtain specimens for natural history exhibits.

#### **3.3.3.1.2 The Protection of New Plant Varieties Act (2000-17)**

This Act was formulated in an effort to address legal obligations imposed by the World Trade Organisation. This legislative framework can be used as a regulatory tool to control biodiversity access. The act also seeks to protect the property rights of plant breeders with respect to flora. In addition to this, the act also seeks to address issues such as the qualification of rights, their entitlement to protection, licenses as well as criminal liability.

#### **3.3.3.1.3 The National Conservation Commission Act 1982**

This act, which establishes the National Conservation Commission, addresses the protection of biota found within various ecosystems across the island.

#### **3.3.3.1.4 The Cultivation of Trees Act (cap.390)**

This Act promotes the cultivation of certain species of trees through the financial incentive of receiving a tax contribution payment equivalent to the amount of taxes payable in respect of the land so

cultivated, the payment of a fruit tree subsidy or subsidy payment. Species currently approved for the incentive scheme are mahogany, casuarina, teak, tamarind and coconut. However, this piece of legislation only supports non-native species. Noting such, efforts should be made to promote incentives for the cultivation of species that are indigenous to Barbados.

#### **3.3.3.1.5 The Trees (Preservation) Act (cap.397)**

This Act demonstrates that the killing of any tree one metre or more in circumference is deemed as an offence unless a valid permit has been obtained from the Chief Town Planner (CTP). The Act also empowers the CTP to demand that the owner(s) of vacant land, adjoining land or land located near a public road to maintain the vegetation. This includes afforestation and reforestation efforts as well as the land clearings of weeds or overgrown grass.

#### **3.3.3.1.6 The Draft National Park Development Plan 1998**

The Draft National Physical Development Plan<sup>195</sup> (NPDP) sought to address biodiversity conservation concerns. The goals and objectives of the NPDP are outlined as follows:

- To conserve and enhance the character and quality of the landscape and marine resources of the park, including all features of natural and cultural heritage;
- To define and protect a functionally connected natural heritage system based on an ecosystem approach;
- To foster an awareness of the value of the National Park to the daily lives of residents of Barbados;
- To ensure that the use and management of the land and marine resources of the park is of a sustainable nature and is supportive of social and economic development of local communities;
- To establish a strong presumption against activities which conflict with or are detrimental to the landscape, seascape and environmental qualities that led to the national park designation;

<sup>195</sup> The Draft National Physical Development Plan (NPDP), 1998, was compiled by the Environmental Management & Land Use Planning for Sustainable Development (EMLUP) Project Team.

- To provide opportunities for informal recreation and to promote understanding and enjoyment of the special qualities of the park; and
- To conserve and enhance the biodiversity of the area including terrestrial and marine ecosystems, habitats and species. (NPDP, 1998)

The plan identifies the following Natural Heritage Conservation Areas and National Forest Candidate Sites. These allocated areas represent part of an ecosystem approach towards the management of the Barbados National Park.

#### *Natural Heritage Conservation Areas:*

- Walkers Savannah, St. Andrew
- Graeme Hall Swamp, Christ Church
- Chancery Lane Wetland, Christ Church
- Folkestone Marine Reserve, St. James
- Carlisle Bay, St. Michael
- Harrison's Cave, St. Thomas

#### *National Forest Candidate Sites:*

- Hackleton's Cliff Woods, St. Joseph
- Joe's River Forest, St. Joseph
- Turners Hall Woods, St. Andrew
- Bruce Vale, St. Andrew
- Pico Teneriffe, St. Peter
- Forest Linkages

### **3.3.3.1.7 The National Biodiversity Strategy and Action Plan 2002**

The National Biodiversity Strategy and Action Plan (NBSAP) is a collaborative effort between Simmons & Associates and the Ministry of Physical Development and Environment<sup>196</sup>. The overarching goal of the NBSAP is to promote the conservation and sustainable utilization of terrestrial, marine and freshwater biodiversity on the island. The outline of the project is based upon Article 6 of the Convention on Biological Diversity, "*General Measures for Conservation and Sustainable Use*" which calls on governments:

- To develop national strategies, plans or programmes for the conservation and sustainable use of biological diversity or adapt for this purpose existing strategies, plans or programmes which shall reflect,

inter alia, the measures set out in this Convention relevant to the Contracting Party concerned; and

- To integrate, as far as possible and as appropriate, the conservation and sustainable use of biological diversity into relevant sectoral or cross-sectoral plans, programmes and policies.

This initiative received technical and financial assistance from the Global Environmental Facility (GEF) and the United Nations Environment Programme (UNEP).

The objectives of the NSBAP are to:

- To identify the current state of knowledge about biodiversity in Barbados;
- To identify important gaps in the knowledge base and the assessment of further needs and associated costs;
- To identify current pressures on biodiversity and future trends;
- To evaluate the present and future value to Barbadians of the country's biodiversity;
- To assess the costs and benefits of conserving biodiversity in Barbados;
- To identify the conservation priorities and strategies for conserving biodiversity;
- To identify appropriate mechanisms or actions to carry out the identified conservation strategies; and
- To identify the institutional requirements to support the implementation of the strategies and actions.

In addition to the NBSAP, recommendations for the conservation and preservation of biological diversity have been included in several documentation. These include the Barbados Sustainable Development Policy; the National Environmental Summary; the Physical Development Plan (Amended 2003); the Barbados Plan of Action; and the National Strategic Plan 2006-2025.

<sup>196</sup> This Ministry is now called the 'Ministry of Environment, Natural Beautification, the Green and Blue Economy'.

### 3.3.3.2 Fresh Water Resources

There are several pieces of legislation that can directly or indirectly influence the management of freshwater resources in Barbados, namely:

- Three Houses Spring Act, 1713;
- The Porey Springs Act, 1864;
- The Underground Water Authority Act 1953 (Cap. 283);
- The Soil Conservation (Scotland District) Act, 1959;
- The Health Services Act and Regulations (1969);
- The Town and Country Planning Development Order, 1972
- The Barbados Water Authority Act, 1980 (Cap.274A); and
- The Marine Pollution Act, 1998<sup>197</sup>.

#### 3.3.3.2.1 The Three-Houses Spring Act, 1713

This act allows inhabitants within the Parish of St. Philip to retain water for residential use. However, during such actions care must be taken to ensure that it does not have negative effects downstream.

#### 3.3.3.2.2 The Porey's Spring Act, 1864

This allows the vestry of the parish of St. Thomas to construct and maintain works for the collection and delivery of water to persons other than the inhabitants of the parish.

#### 3.3.3.2.3 The Underground Water Authority Act 1953 (cap. 283)

CAP. 283 of the Act stipulates that a license is needed for the abstraction of underground water.

#### 3.3.3.2.4 The Health Services Act and Regulations (1969)

Cap 44 of this Act is coordinated by the Environmental Protection Department. The Act is responsible for the promotion and preservation of the health of inhabitants. Health in this regard does not only refer to the absence of disease but also includes the physical, mental and social well-being of the inhabitants of Barbados.

<sup>197</sup> This act governs both freshwater and marine resources on the island.

#### 3.3.3.2.5 The Barbados Water Authority Act, 1980 [Cap.274A]

This Act manages, allocates and monitors the water resources. The act seeks to ensure the efficiency and effectiveness of the BWA operations to ensure the proper utilization, conservation and protection of water resources. Access to water is readily available on the island. Between 96-98% of all inhabitants are connected to the public water supply system whereas the remaining 2-4% can easily access the public water supply.

### 3.3.3.3 Coastal and Marine resources

The Coastal Zone Management Unit (CZMU) is the primary government entity charged with the mandate of undertaking research and assessments of marine resources within Barbados. The Fisheries Division is solely responsible for the assessment of fish stocks.

#### 3.3.3.3.1 Marine Protected Areas

The National Conservation Commission (NCC) is the government agency that is responsible for the management of marine protected areas in Barbados. There is only one legislated marine protected areas on the island – the Folkestone Park and Marine Reserve. However, concerted efforts have been made by the CZMU to designate the Carlisle Marine Park as another protected area.

#### *The Folkestone Park and Marine Reserve (FPMR)*

This was established in 1981 under the Designation of Restricted Areas Order 1981 and the Marine Areas (Preservation and Enhancement) (Barbados Marine Reserve) Regulation 1981. The reserve is located within an area of historical significance in Holetown. It lies in close proximity to the official landing site of the English settlers in 1627. The FPMR not only provides a sanctuary for marine biota, but also provides economic activities in the surrounding communities, opportunities for education and scientific research as well as a site for recreational activities. Box 6 shows the mission statement of the FPMR:

#### **Box 6: The Mission Statement of the Folkestone Park and Marine Reserve**

To provide high quality recreational activities for Barbadians and visitors that will educate and entertain them. We believe in sustaining the natural marine environment and exposing our guests to its beauty. Our service will provide for family-oriented entertainment utilising modern technology and provide for a financially strong park that the nation will be proud of.

The reserve spans a total distance of 2.2 km<sup>198</sup>. It extends a total distance offshore of 950 metres at its widest point and 660 metres at its narrowest. As seen in Table 10, the reserve is supported by major legislative frameworks and consists of four exclusive zones<sup>199</sup> (as seen in Figure 50):

- A scientific zone<sup>200</sup>;
- A Northern Water Sports Zone;
- A Southern Water Sports Zone; and
- A recreational zone.

**Table 10: Some Major Legislative Frameworks supporting the management of the FMPR**

Legislation	Areas of Concern
The Barbados Water Authority Act. 1980	Protection of nearshore bathing water quality
The National Conservation Commission Act. 1982	Laws relating to public parks, beaches, caves. etc. and the establishment of the National Conservation Commission
Town and Country Planning Act. Ch.240. 1985	Controls development and the disposal of waste
Barbados Port Authority (Water- Sports) Order. 1990	Laws governing watersport activities
Fisheries Act. 1993 (Amended 2000)	Relates to the management, conservation and development of the fishing industry as well as prohibited activities; facilitates the creation of new regulations
Fisheries (Management) Regulations. 1998	Outlines prohibited fishing activities and the associated penalties (including coral harvesting)
Marine Pollution Control Act (1998-40)	Stipulates the permissible levels of pollutants that could be discharged into the marine environment
Coastal Zone Management Act. 1998	Preservation and enhancement of coastal resources
Marine Areas (Preservation and Enhancement) (Restricted Areas) Regulations. 1998	Governs the zonation of Folkestone and the permissible activities in each zone
Marine Areas (Preservation and Enhancement) (Designation of Restricted Areas) Order, 1998	In place of the 1981 order, allows for the establishment of restricted areas

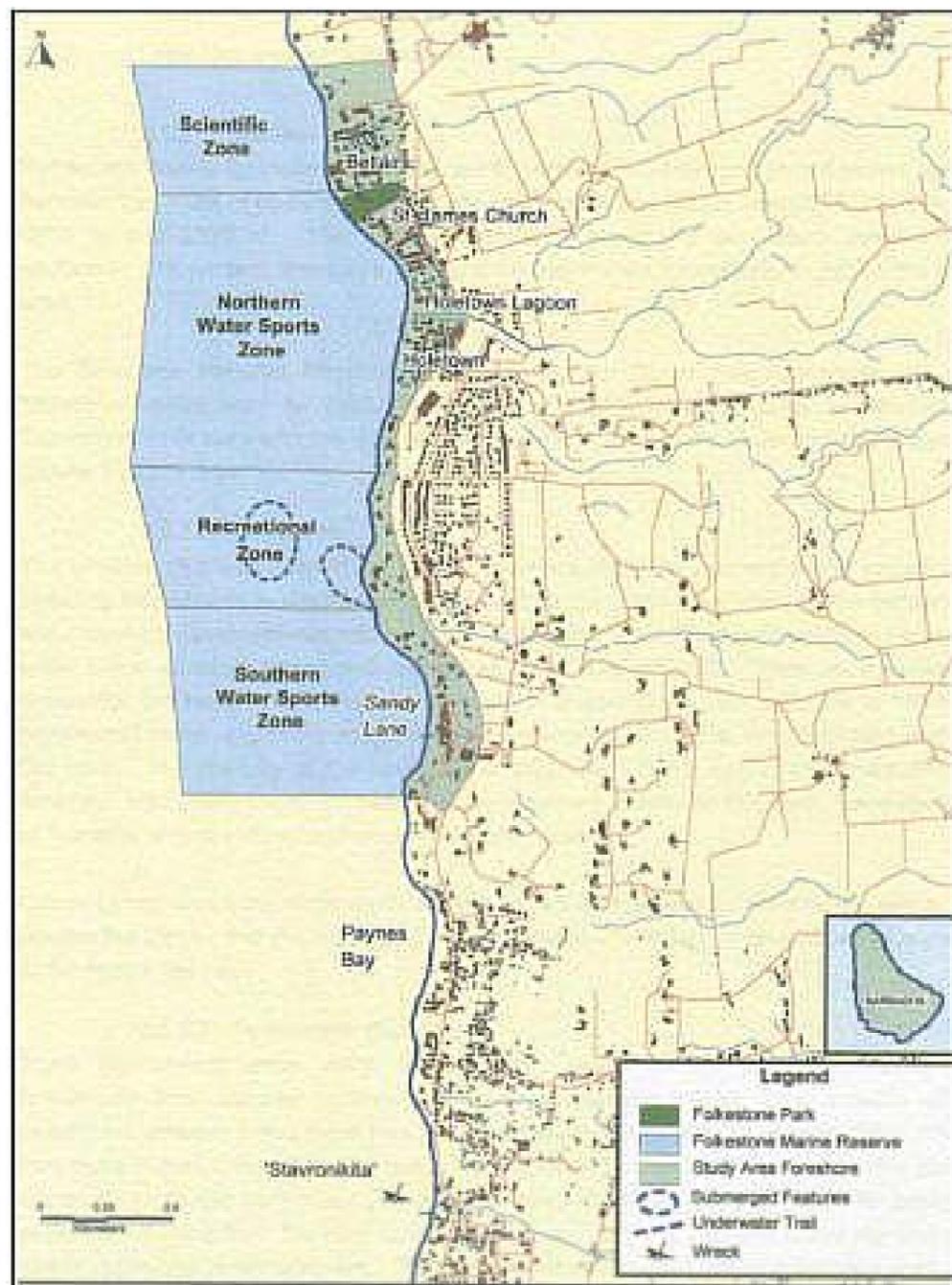
Source: AXYS et. al 2000, Fisheries Division 2001

198 The Folkestone Marine Park and Reserve accounts for 11% of the West Coast of Barbados.

199 Cumberbatch et al., 2001

200 Even though the FPMR was separated into exclusive zones to promote the sustainable use of the environs, only one-eighth of the zone is designated to scientific research.

Figure 50: The Exclusive Zones within the Folkestone Park and Marine Reserve



Source: Cumberbatch. 2001

In addition, the management of the reserve has sought to promote educational awareness through a variety of projects and programmes. These include:

- The establishment of a local network of stakeholders and providing training to community groups in coral reef ecosystem awareness as well as management and planning for long term sustainability;
- Education, targeting primary schools via the distribution of "People and Corals Workbooks" to sixty-eight (68) schools and the establishment of the Folkestone Marine Reserve Summer Camp targeting mainly Primary Schools which is now in its third year;
- Development of the junior coral reef ambassadors programme currently in effect at the Alexandra School and soon to be implemented at the St. James Secondary School;
- Initiation of the Reef Watchers Programme which is a community-based coral reef monitoring regime to facilitate the development of a coral reef monitoring database, and involves local divers working together with scientists to monitor selected reefs within the reserve;
- Establishment of a community forum and the production of a bi-monthly e-newsletter; and

- Development of partnership agreements with private sector agencies including an “Adopt-the-Reserve” Initiative with local hotels, businesses and residents to establish a closer working relationship with the management of the reserve, and a Buoy Maintenance Programme with local dive operators, adjacent to the Reserve.

#### **Carlisle Bay Marine Park**

Located on the southwestern coast of Barbados, this calm and sheltered designated area acts as a site for recreation and blue economy activities on a daily basis. The Carlisle Bay Marine Park is the primary location on the island for snorkelling, diving, anchoring and sailing of yachts. The extent of marine biodiversity in the bay is parallel to no other biome on the island. The biodiversity is extremely rich, with more than three hundred and fifty (350) species of tropical flora and fauna. At present, there are five (5) major wrecks within the bay area: (i) the Berwyn; (ii) the Fox, (iii) the C-Trec, (iv) the Bajan Queen and (v) the Eillon. On a weekly basis, these wrecks attract more than forty (40) dive boats and glass bottom boats.

#### **3.3.3.3.2 The Marine Pollution Act, 1998**

The Act focuses on the quality of the marine waters along the south and west coasts of the island. The legislation has been approved to help combat the steady deterioration of coastal water quality in some locations. Such deterioration was caused due to the increased physical development occurring along the coastline over the last three (3) decades. For coastal communities worldwide, poor water quality poses a serious threat to human, fisheries and marine ecosystem health. Overall, this legislation seeks to prevent, reduce and control pollution from various sources. The Act recognizes that most marine pollution originates from land-based sources and activities.

#### **3.3.3.3.3 The Coastal Zone Management Unit Act**

The Coastal Zone Management Act (1998-39) provides a comprehensive statutory basis for coastal management and planning in Barbados. It seeks to coordinate and to update the existing fragmented statutes relevant to coastal management whereby making provision for critical areas of concern not covered by current legislation. The Act provides the legal basis for the preparation of a Coastal Management Plan, which establishes and clearly sets out the Government's coastal management

policy and technical guidelines governing the use and allocation of coastal resources. The Act specifically deals with the protection of marine resources. This includes the destruction of corals and fouling of the foreshore. It also encompasses the designation of Marine Protected Areas and Marine Parks. This Act repeals the Marine Areas (Preservation and Enhancement) Act (Cap.392).

#### **3.3.3.3.4 The Defence Act, 1979**

This Act outlines multi-purpose surveillance within Barbados' Exclusive Economic Zone (EEZ) and territorial waters. The Act is enforced by the officers and soldiers of the Defence Force which serve as members of the Barbados Coast Guard. This defence arm enforces the provisions of every law relating to the regulation of any harbour or port within Barbados. It also oversees quarantine; immigration; fisheries; territorial waters and economic zones; as well as safety at sea. The defence arm also detects and prevents the contravention of laws relating to revenue and customs; prevents persons from boarding, holding or clinging on to any vessel without the permission of the master of the vessel, and, if necessary, remove any such person from the vessel. For the purposes of carrying out their duties, the members of the Barbados Coast Guard have the same powers, authorities and privileges that are conferred by law on members of the Barbados Police Force.

#### **3.3.3.3.5 The Shipping Act, 1994**

The Shipping Act seeks to govern maritime activities at sea whether directly or indirectly. The purposes of this Act are:

- To encourage and regulate the orderly development of merchant shipping in Barbados and to provide for the qualifying of persons employed in service at sea in Barbadian ships;
- To regulate the terms and conditions of service of persons employed in Barbadian ships in conformity with international conventions to which Barbados adheres;
- To provide for the safety of passengers, crews, ships and cargo in conformity with any international conventions to which Barbados adheres;
- To regulate and provide for the safety of persons engaged in diving activity in the Exclusive Economic Zone of Barbados;

- To regulate the use of small commercial vessels within the Exclusive Economic Zone of Barbados; and
- To prevent or mitigate the effect of shipping activity on the marine environment in the Exclusive Economic Zone of Barbados.

#### **3.3.3.3.6 The Fisheries Act**

The Fisheries Act 1993 (Cap. 391) addresses the provision for the management and development of fisheries (including protection of endangered and critically endangered sea turtles from exploitation) in Barbados.

#### **3.3.3.3.7 Fisheries Management Regulations**

The Fisheries Management Regulations (1998) address closed areas and seasons. It also details fishing methods and equipment to be adopted, and protective measures for lobsters, turtles, sea eggs and tuna.

#### **3.3.3.3.8 The Barbados Terrestrial Waters Act**

The Barbados Territorial Waters Act 1977 (1977-26) defines the territorial waters of Barbados – a region which spans 12 nautical miles around the island. Section 3(2) provides that these waters, including the underlying seabed and subsoil, form part of the territory of Barbados and are, therefore, subject to full territorial sovereignty. Foreign vessels have a right of 'innocent passage' through the territorial waters. However, the right is voided if the captain or other person in charge of the ship engages in any calculated act of pollution or acts likely to cause harm to Barbadian resources or its marine environment.

#### **3.3.3.3.9 The Marine Boundaries and Jurisdiction Act**

The Marine Boundaries and Jurisdiction Act 1979 (cap. 387) establishes a 200 mile EEZ in which sovereign rights are vested in the GoB. These sovereign rights include the exploration, exploitation, conservation, protection or management of the natural living and non-living resources of the sea-bed, subsoil and superjacent waters. It also includes the preservation and protection of the marine environment as well as the prevention and control of marine pollution. Barbados has all other rights in and jurisdiction over the EEZ recognized in international law.

#### **3.3.3.3.10 Draft Recreational Diving Operations Regulations, 1998**

These regulations, which represent a segment of the Shipping Act, are currently in the draft stage. The proposed regulations seek to govern the dive operations for hire and reward in Barbados. The aim of such regulations is to ensure the safety of dive operators and their clients as well as the preservation of fragile marine ecosystems.

#### **3.3.3.3.11 The Graeme Hall Swamp and Nature Reserve**

The Graeme Hall Nature Sanctuary represents the largest and most significant wetland within Barbados. This mangrove swamp is located within one of the most densely populated areas outside of the island's Central Commercial District. The sanctuary has undergone extensive reconstruction and has marketed itself as a recreational site for family-oriented events. Covering a landmass of thirty (30) hectares, the area is colonized by red and white mangroves, which are the dominant species within the wooded parts of the swamp. The man-made drainage canals contain a variety of plants including water lilies, water lettuce and filamentous algae while sedges, grasses and other wetland plants grow on the banks. This swamp provides a watering hole for many migratory birds and permanent home for several resident birds. These include the locally rare red seal coot and the yellow warbler. The swamp also serves as a sanctuary for many juvenile marine fish and provides a recreational site for bird watching, fishing, and model boat racing.

#### **3.3.3.4 Land Resources**

The Land Use Policy for Barbados is governed by the Physical Development Plan. Other pieces of legislation that can directly or indirectly influence the management of land resources include:

- The Constitution
- The Town and Country Planning Act
- The Land Acquisition Act
- The Police Act, 1961-50
- The Statistics Act 1958 (Cap.192)
- The Barbados Agricultural Development and Marketing Corporation Act (12/1993)
- The Soil Conservation (Scotland District) Act (Cap. 397)
- The Trees (Preservation) Act (cap.397)

#### **3.3.3.4.1 The Constitution**

The Constitution (Section 16) provides for the protection from deprivation of private property. The establishment of protected areas or the imposition of planning restrictions that deprives the land of its value could attract legitimate claims for compensation. Section 16 also allows for the confiscation of property in circumstances where the environment is threatened.

#### **3.3.3.4.2 The Town and Country Planning Act**

The Town and Country Planning Act 1985 (cap.240) makes provision for the orderly and progressive development of land. The Act provides for the preparation of a Physical Development Plan by the Chief Town Planner (CTP) which may make provision for the following measures:

- Allocation of lands as open spaces, communal parks, bird and other sanctuaries, protection of marine life;
- Preservation of sites of artistic, architectural, archaeological or historical interest;
- Preservation or protection of forests, woods, trees, shrubs, plants and flowers; and
- Regulation and control of the deposition of waste materials, refuse, sewage and the pollution of rivers, lakes, ponds, gullies and the seashore.

With respect to agriculture and livestock, the Act contains some provision relevant to the use of land for the purpose of agriculture or forestry, including forestation and the use of any agricultural purpose, other than dairy farming and the breeding and keeping of livestock, including any creature kept for the production of food, wool, skin or for the purpose of its use in farming the land.

#### **3.3.3.4.3 The Land Acquisition Act**

The Land Acquisition Act (cap. 228) makes provision for the acquisition of land for public purposes, such as the development of parks or caves.

#### **3.3.3.4.4 The Police Act, 1961-50**

This act seeks to amend and consolidate the Acts of Barbados relating to the Police Force. The Force shall be primarily employed for the maintenance of law and order; the preservation

of peace; the protection of life and property; the prevention and detection of crime; and the enforcement of all laws and regulations with which it is charged.

#### **3.3.3.4.5 The Statistics Act 1958 (Cap.192)**

An Act to facilitate activities related to the compilation of the national censuses and for the collection, compilation, analysis and publication of certain statistical information and for other matters relating to it.

#### **3.3.3.4.6 The Barbados Agricultural Development and Marketing Corporation Act**

The Barbados Agricultural Development and Marketing Corporation Act (BADMCA) (12/1993) provides for the establishment of the Barbados Agricultural Development and Marketing Corporation and for related matters.

#### **3.3.3.4.7 The Soil Conservation (Scotland District) Act, 1959**

This Act restricts land use in the Conservation Area known as the Scotland District - an area comprises both the hinterland and the coastal zones in the parishes of St. Peter, St. Andrew, St. Joseph and St. John<sup>201</sup>.

#### **3.3.3.4.8 Green Spaces**

These areas are characterized according to the International Union for the Conservation of Nature (IUCN)<sup>202</sup> classifications. However, the classification of such areas is not limited to National Conservation Areas. Table 11 shows the classification, description and the locations of green spaces in Barbados.

201 Government of Barbados. 2010. "The National Environmental Summary".

202 See Appendix IX for a Map outlining the Barbados System of Parks and Open Spaces.

**Table 11: IUCN Classifications of Parks and Open Spaces in Barbados**

Classification	Description	Location of Areas
<b>OS 1: Barbados National Park</b>	This designation applies to the entire area of the national park. It encompasses various land use activities including forestry, conservation, tourism, resource extraction, and rural village settlements.	The Scotland District
<b>OS 2: Natural Heritage Conservation Areas</b>	These include features and locations that are important to the natural and physical heritage of the island. This designation encompasses both terrestrial and marine environments, which are deemed to require protection from urban and recreational development pressures.	St. Lucy Coastal Cliffs, Long Pond and Walker's Beach.
<b>OS 3: Coastal Landscape Zones</b>	This designation refers to two coastal areas outside of the national park, which are said to exhibit natural character and possess unique physical or cultural attributes.	The Coastal Landscape Protection Zone extends from Salt Point to Conset Bay and from Archer's Bay to Maycock's Bay.
<b>OS 4: Public Parks and Open Spaces</b>	These include publicly owned sites in both urban and rural settings that have been designed specifically to serve as recreation areas.	Queen's Park and Farley Hill Recreational Park.
<b>OS 5: National Attractions</b>	This designation refers to attractions used for public enjoyment.	St. Nicholas Abbey and Bathsheba.
<b>OS 6: Barbados National Forest Candidate Sites</b>	These are crown-owned sites, which are predominately covered in mature or emerging forests.	Joe's River Forest, Hackleton's Cliff and Woods, Turner's Hall Woods, Bruce Vale and Pico Teneriffe.

Source: The Barbados Town and Country Planning Department

#### **3.3.3.4.9 The Barbados Wildlife Reserve**

The Barbados Wildlife Reserve is located in close proximity to the Farley Hill National Park in St. Peter. The reserve, which spans four acres of mahogany forest, was established in 1980. The aim of the reserve is to ensure the protection of endemic species such as the Barbados Green Monkey and non-native species such as flamingos and reptiles. Within the reserve, a vast majority of these animals are allowed to roam freely without separation from visitors.

## 3.4 Institutional Framework

This section provides an overview of the institutional framework to support disaster risk management efforts at the national, local and community levels.

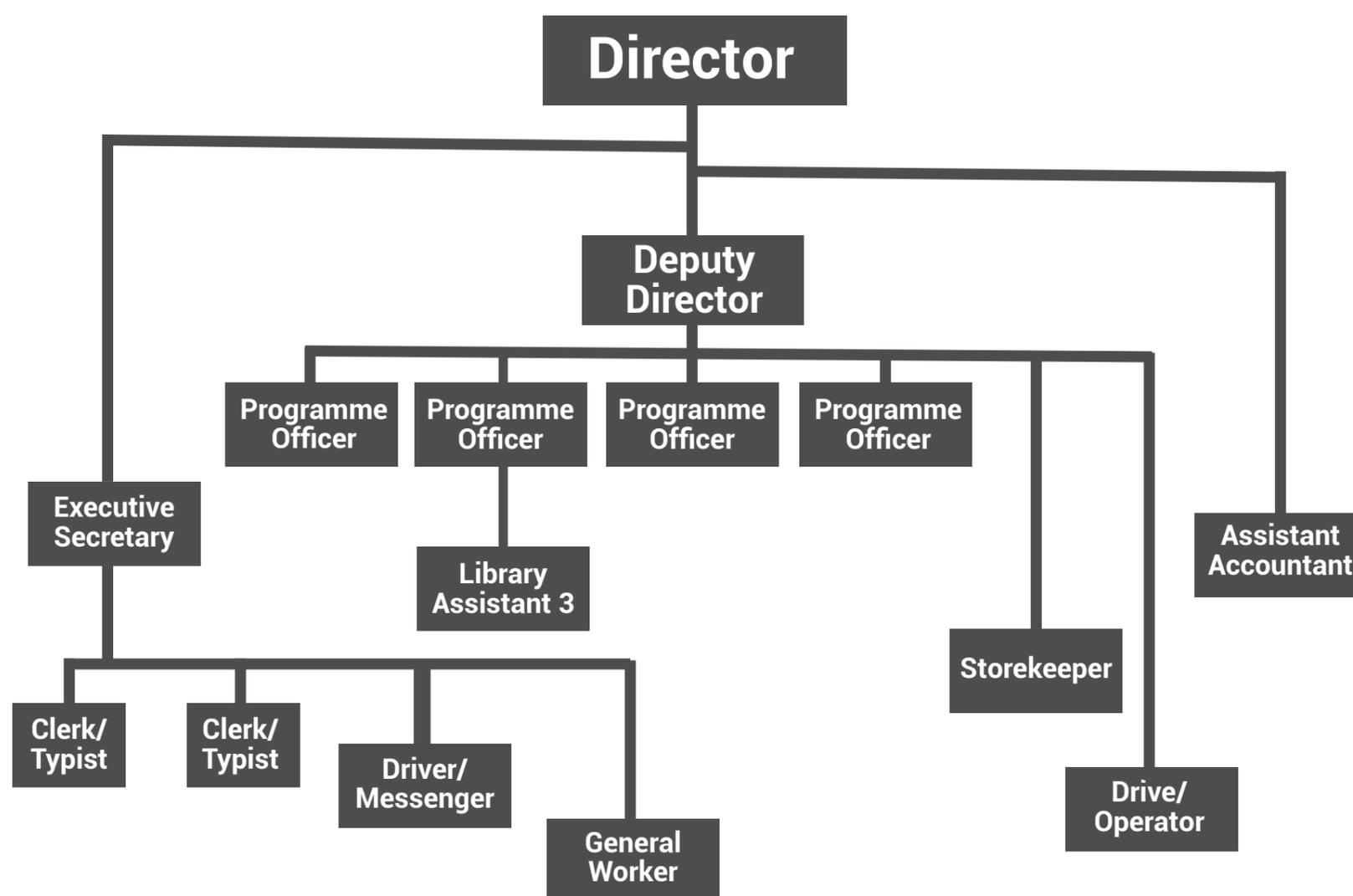
### 3.4.1 National Context

This section provides an overview of the institutional framework to support disaster risk management efforts at the national level.

#### 3.4.1.1 The Department of Emergency Management

The national entity responsible for coordination emergency management activities in Barbados is the Department of Emergency Management (DEM) which falls under the auspices of the Ministry of Home Affairs and Information. Established in 2007, under the statutory legislation entitled '*The 2007 Emergency Management Act, Cap 160A*'. The DEM is preceded by the Central Emergency Relief Organisation<sup>203</sup> (CERO) Secretariat (established in 1978) and also the Organization for Hurricane Relief<sup>204</sup> (established in the 1940s) – the latter two of which represent organizations solely responsible for disaster relief activities on the island during the colonial and post-colonial eras. The DEM's organization chart can be seen in Figure 51.

Figure 51: The Organizational Chart for the Department of Emergency Management



Source: The Department of Emergency Management

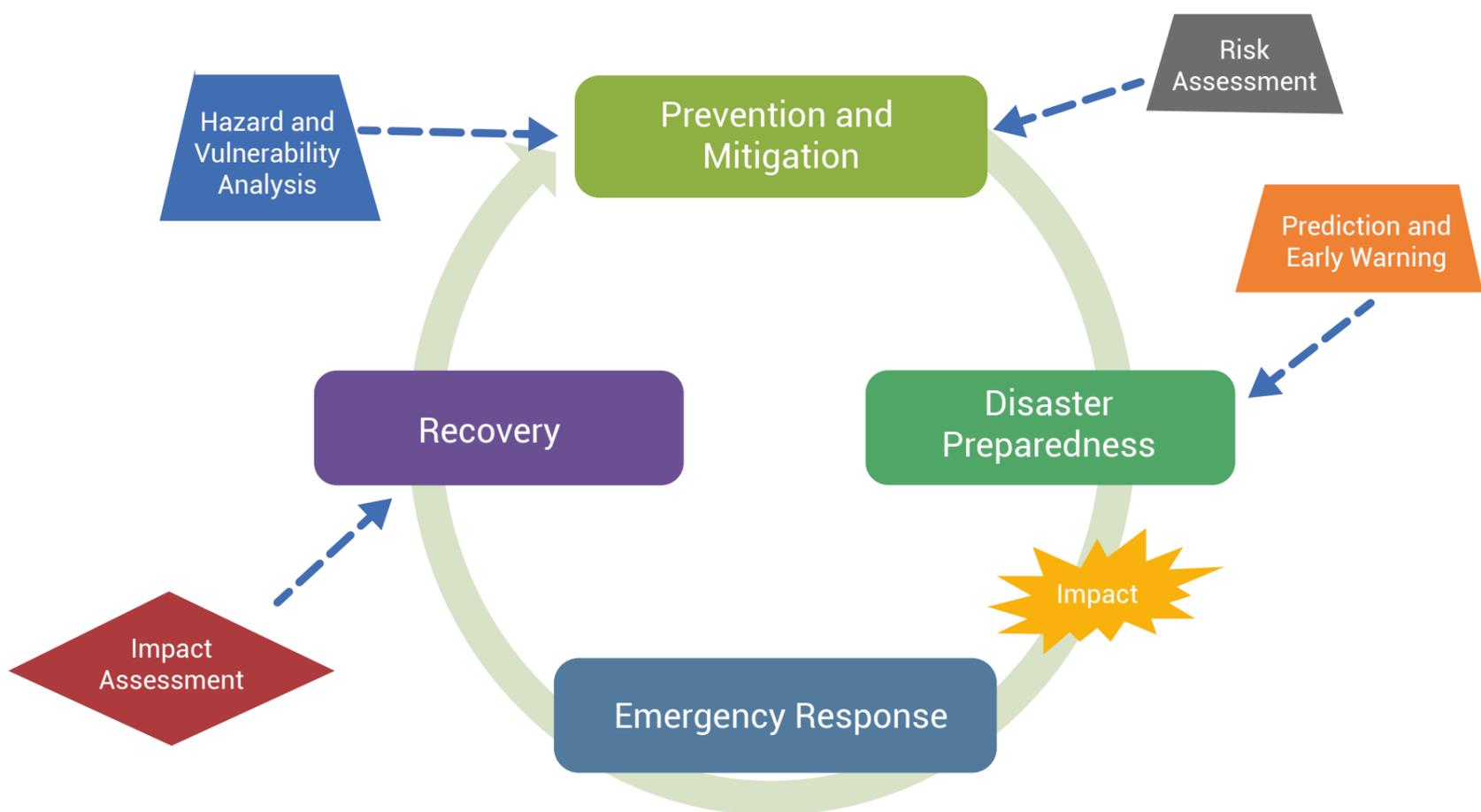
203 The Central Emergency Relief Secretariat which provided administrative support and coordination to the wider disaster management system in Barbados.

204 In contrast to the Department of Emergency Management, this Organization was never fully aware of the need for a plan for disaster preparedness, although the public was informed of an impending hurricane in the form of public warning which were arranged according to the standard hurricane categories of Advisory, Cautionary Warning and the onset of a hurricane.

The Emergency Management Act (2007) further makes provision for: inter alia, country-wide emergency management planning and administrative mechanisms, Environmental Impact Assessments, special area planning, and the delineation of vulnerable areas. To underscore its commitment to disaster resilience efforts on the national and local scales, the GoB has embarked upon several initiatives: (i) The National Multi-Hazard Disaster Management Plan (NMHDMP)<sup>205</sup>, and in draft form (ii) A Chemical, Biological, Radiological and Nuclear Response Plan.

The Department of Emergency Management (DEM) has adopted the Caribbean Disaster Emergency Management Agency's (CDEMA) Comprehensive Disaster Management Strategy and Framework which guides the national disaster management agenda and explicitly makes the linkages among disaster risk management, sustainable development and climate change. To date, the DEM has spearheaded the development and implementation of the National Comprehensive Disaster Management programme, through the utilization of the integrated management approach, which focuses on DRM advocacy, institutional strengthening of the National Emergency Management System, community disaster risk resilience, DRM mainstreaming in key sectors, and the incorporation of science in DRM. This integrated management approach not only promotes efficiency and effectiveness in the achievement of the Department's mission to the general populace, that is 'through the identification and mobilisation of all appropriate resources and detailed planning for the possible impact of any hazard', but also encompasses all phases of disaster management irrespective of the inherent nature of the threat posed. Within this continuum of sorts, the phases of DRM can be seen in Figure 52.

**Figure 52: The Disaster Management Cycle**



Source: Author's Adaptation of DEM, 2014

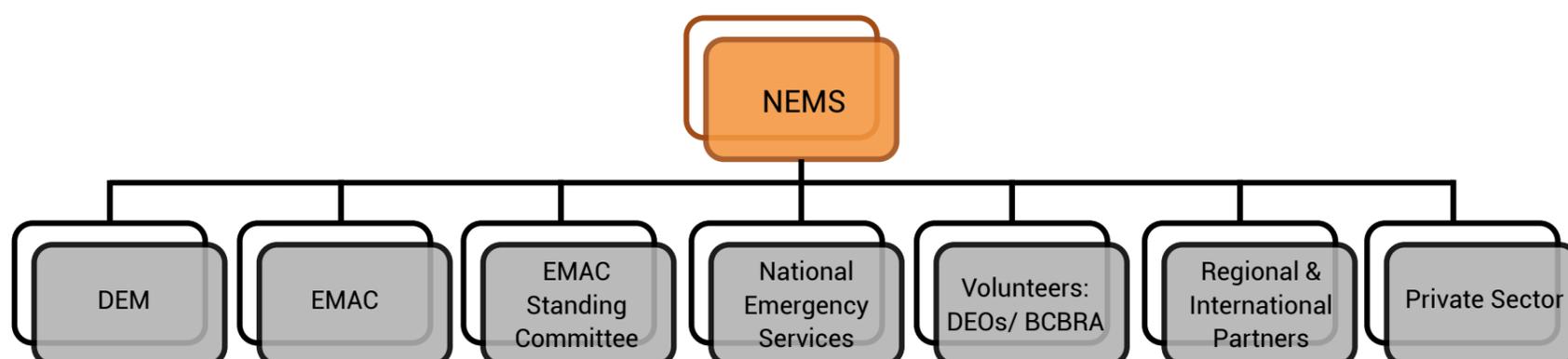
205 See Appendix II

Whilst in adherence with current global and regional frameworks, the DEM also supports the attainment of the Sustainable Development Goals within the Barbadian context. The DEM aims to achieve such outcomes via the following objectives:

- i. To educate all citizens about the various elements of disaster management.
- ii. To create appropriate mechanisms which will promote and advance disaster management activities at all levels of the society;
- iii. To promote and institutionalize the practice of appropriate preventative and mitigation measure for all possible hazards; and
- iv. To promote the development and maintenance of effective warning, response and recovery plans for all sectors of the society.

Disaster management activities on the island are conducted via a National Emergency Management System (NEMS) which acts as the overarching mechanism to facilitate coordination across various ministerial portfolios and departments under the auspices of the GoB. The DEM acts as the administrative arm on the NEMS. Cognisant of the fact that effectively managing disaster risk and building a resilient society is of paramount importance to maintaining a trajectory of continued sustainability, the Barbados Country Work Programme 2019-2023 (CWP) outlines the components of the NEMS. As seen in Figure 53, the components include many state and non-state actors. In particular, the following entities (as depicted in Table 12) play a pivotal role in emergency management efforts on the island.

**Figure 53: An Overview of the National Emergency Management System**



Source: The Barbados Comprehensive Disaster Management (CDM) Country Work Programme (CWP) (2019 – 2023)

As it relates to extreme weather events, the control and prevention of inland flooding is the responsibility of the Drainage Unit, which, in collaboration with the Town and Country Development Planning Office is also expected to ensure construction activity allows for adequate drainage. Additionally, the Coastal Zone Management Unit monitors coastal erosion and vulnerability; while the Ministry of Agriculture monitors soil erosion in the Scotland District which is susceptible to significant land slippage (SALISES, 2012). All past CZMU projects have been building toward DRR, particularly along the urban west and south coasts. Each project has updated the monitoring processes and coastal data, implemented engineering works for increased coastal resilience, and supported institutional capacity building.

**Table 12: Disaster Management Coordination in Barbados**

Entity	Aim/Rationale	Coordinating Bodies
<b>Emergency Management Advisory Council</b>	The overarching committee responsible for the execution of the National Emergency Management System across various ministries and departments on the island <sup>206</sup> .	Representatives of the National Disaster Committee which is called the Emergency Management Advisory Council (EMAC) whose membership comprises of representatives of the Emergency Services, key government ministries and departments, the Private Sector, Non-Governmental Organisations NGOs, Community Based Organisations CBOs and international and regional emergency management organizations.
<b>Emergency Management Standing Committees</b>	These standing committees execute national disaster management policy and programmes in their respective areas of expertise such as Shelter Management, Evacuation, Mass Feeding, Damage Assessments and Needs Analysis, Emergency Telecommunications, Public Utilities amongst others.	Technical Heads of Government agencies (All Ministries and Departments) responsible for: Public Information (PIEC), Damage Assessment and Statistics (DASC), Health and First Aid Services (HFASC), Food and General Supplies (FGSC), Public Utilities (PUC), Emergency Transport (ETC), Road Clearance and Tree Trimming (RCTTC), Welfare Services (WSC), Shelter Management (SMC), Telecommunications (TEC), Emergency Housing and Rehabilitation (EHRC), National Mitigation (NMC), Tourism Emergency Management (TEMC), and Technical Standing Committee on Coastal Hazards (TSCCH)
<b>The National Emergency Operations Centre (NEOC)<sup>207</sup></b>	The centralised location from which the mobilisation and coordination of responses and resources is carried out in the event of a major incident, emergency or disaster. The operations provide 24-hour service.	Emergency Operations Centre Management Teams comprised of technical heads/representatives of the agencies from the National Disaster Committee.
<b>District Emergency Organisations (DEO's)</b>	The role of the DEO's is to organize and coordinate the resources of the community so as to allow for an effective response in time of crisis.	Department of Emergency Management

<sup>206</sup> See Appendix III for the list of current representation under the aforementioned committees

<sup>207</sup> The primary functions of the Teams are: (i) Notification of key individuals and appropriate agencies; (ii) Mobilising additional and extra ordinary resources; (iii) Collecting, collating and analysing information; (iv) Prioritising response activities; (v) Warning and keeping the public updated on the progress of the incident, the need for evacuation or other precautions and the termination of the incident; (vi) Coordinating Damage Assessment and conducting Needs Analysis and (vii) Coordinating Emergency Relief and Initial Rehabilitation activities.

There are two (2) overarching legislative frameworks that govern disaster management activities in Barbados: (i) Policy Framework and Standard Operating Procedures for the Systematic National Shutdown and Reactivation of Barbados: The National Shutdown and Reactivation policies; and (ii) 2007 Emergency Management Act Cap 160A, as seen in Table 13.

**Table 13: Overarching Disaster Management Policies in Barbados**

Policy Name	Aim/Rationale	Coordinating Bodies
<b>National Shutdown policy</b>	To issue a National Shutdown Administrative directive from the Director of the Department of Emergency Management on behalf of the GoB in light of a hazardous event.	Director, Department of Emergency Management; Select Committee of the Emergency Management Advisory Council
<b>National Reactivation Policy</b>	To issue a national Reactivation directive from the Director of the Department of Emergency Management on behalf of the GoB after the occurrence of a hazardous event. This occurs in two (2) phases after the 'All Clear' has been given: <ul style="list-style-type: none"> <li>i. Emergency services, security forces and frontline/first responders and</li> <li>ii. The general public</li> </ul>	Director, Department of Emergency Management; Director of Meteorological Services. This instruction will be issued to the emergency services, security forces and frontline/first responders who are part of the Emergency Telecommunications System <sup>208</sup> .
<b>2007 Emergency Management Act, Cap 160A</b>	Provides legislative authority for the mainstreaming of Comprehensive Disaster Management and responsibility to the Emergency Management Advisory Council for recommending policies, programmes and activities to enhance the emergency management programme, management of 16 Standing Committees responsible for advancing detailed sectoral disaster management planning, and 30 voluntary District Emergency Organizations through which the community disaster management programme is facilitated.	Department of Emergency Management

Source: Department of Emergency Management

### 3.4.1.2 The Barbados Water Authority

The Barbados Water Authority (BWA) is a statutory corporation that was established in . It is the sole entity responsible for freshwater resources – except those resources under the Three Houses and Porey's Spring Acts. The mandate of the BWA is:

*"To manage, allocate and monitor the water resources of Barbados with a view to ensuring their best development, utilization, conservation and protection in the public interest."*

Additional responsibilities include the design, construction, acquisition, provision, operation and maintenance of water and sewerage works for the purpose of supplying water for public purposes and the receiving, treating and disposing of sewage, respectively<sup>209</sup>.

208 Agencies include the Royal Barbados Police Force, the Barbados Fire Service, the Ministry of Public Works, the Barbados Defence Force, the Barbados Light and Power Company, the Grantley Adams International Airport, the Barbados Port Inc. and the island's main Telecommunication providers: Digicel and FLOW.

209 Excerpt from the 'Freshwater Country profile – Barbados (FRESHWATER2004-BARBADOS)', available at: <http://www.un.org/esa/agenda21/natlinfo/countr/barbados/freshwater.pdf>

### 3.4.1.3 The Coastal Zone Management Unit

The Coastal Zone Management Unit is a scientific government agency which specializes in the environmental management of the Barbadian coastline. The establishment of this unit in 1996 stemmed from the creation of the Coastal Conservation Project Unit in 1983. The CZMU seeks to assess the coastal management of the island by conducting routine monitoring and analyses of oceanographic conditions around the island, monitoring the health of coastal habitats; updating the inventory of coastal resources and structures; regulating marine research and consulting with entities such as the Town and Country Development Planning Office (TCDPO) regarding all coastal development, beach erosion and accretion monitoring and control. Through public education, the CZMU engages stakeholders at all levels about the impact that coastal degradation poses for the Barbadian economy. The mandate<sup>210</sup> of the CZMU is:

*“To design and implement an effective, comprehensive Coastal Zone Management Plan for the island and to ensure that the coast retains its vital and pivotal role in the economic, social and physical development of Barbados”.*

### 3.4.1.4 The Environmental Protection Department

The Environmental Protection Department - formerly called the Environmental Engineering Division - was established in 1971. The aim of the organization is to promote sustainable environmental practices by enforcing legislation, monitoring conditions that can pose detrimental effects on air, water and land quality as well as the general well-being of all citizens in Barbados. In addition, the unit is responsible for evaluating and controlling indoor and ambient air quality.

### 3.4.1.5 The National Assistance Board

Established in 1969, the National Assistance Board originally acted as an Advisory Board under the National Board Act. From May 1980 onwards, the Nab has acted as one of the Government's Social Assistance Agencies with direct responsibility for the administration of the Housing Programme, the Proposed Home Help Service and the National Day Care Programme. The board also provides a range

of services for highly disadvantaged segments of the population - particularly the elderly and indigent persons. The NAB is governed by the National Assistance Act, 1969-37 which outlines the functions of the minister, the establishment of the National Assistance Board, the functions of Chief Welfare Officers and Appeals and regulations regarding Old Age pensions. National assistance may be provided to a person who is in need by reason of his being prevented by some disability from earning a living, or who has no resources to maintain himself and is unable to find work and shall normally be given to the person who in the opinion of the Welfare Officer is the head of a family and whose needs shall be deemed to include those of his dependants. National assistance may consist of assistance in cash or in kind provided as a matter of necessity. A cash grant may be awarded— in the case of a person who—is so blind as to be unable to perform any work for which eyesight is essential, or is so deaf and dumb as to be incapable of effectively receiving and making verbal communication, for such period as the Chief Welfare Officer determines; in any other case, for any period of from 1 to 26 weeks duration, and may be renewed on the expiration of such period. A cash grant awarded shall be payable at the appropriate rate prescribed by regulation 21 (1), and shall not at any one payment exceed an amount equal to two weeks grant.

### 3.4.1.6 The National Conservation Commission

This statutory authority - formerly called the Parks and Beaches Commission – was established in 1970 and is responsible for the preservation and beautification of the island's parks and beaches. The mandate of the NCC is:

*“To maintain, develop, conserve, preserve and enhance our natural and man-made environment, through the provision of quality service to our stakeholders”.*

The main functions of the NCC are to maintain functions to conserve the natural beauty of Barbados; control and develop public parks; public gardens, beaches and caves; advise on the removal of coral from the ocean bed; and regulate commercial activities in public parks, gardens, caves, and on beaches.

### 3.4.1.7 The National Heritage Department

This department is responsible for the maintenance and conservation of the cultural heritage of Barbados. This heritage not only encompasses

210 The Coastal Zone Management Unit Website, available at <http://www.coastal.gov.bb>

the built environment but also includes areas and monuments of archaeological significance. The objectives of the NHD are outlined as follows:

- Upgrade, diversify and protect Barbados' tourism product through development of sites that can serve as attractions and recreational areas while providing opportunities for scientific research and employment of residents.
- Protect the quality and integrity of ecosystems including air, water, land and animal components.
- Focus on the linkages and relationships among the ecosystems, with special attention to human activities, and consider these components beyond their immediate environs to the broader National Park system, and to the island system as a whole.
- Promote the protection, conservation and wise use of Barbadian flora.
- Establish and develop linkages between the Town and Country Planning Office, the Coastal Zone Management Unit, the National Conservation Commission and Soil Conservation Unit with other Ministries and NOOs.
- Promote community participation and educational programmes in the Harrison's Cave study area.

#### **3.4.1.8 The Sanitation Service Authority**

The Barbadian government has reaffirmed its commitment to proper waste management. The entity responsible for the collection of municipal solid waste is the Sanitation Service Authority. There are four solid waste disposal sites on the island, these include:

- Mangrove Pond Landfill
- Bagatelle Bulky Waste Disposal Site
- Rock Hall Asbestos Disposal Site
- Lonesome Hill Blood & Grease Disposal Site

#### **3.4.1.9 The Ministry of Health and Wellness**

Governed by the Health Services Act (1969-38), the Ministry of Health and Wellness is the government entity responsible for promoting and managing the health of the Barbadian populace through the provision of comprehensive, coordinated and integrated care, supported by appropriately trained staff, national leadership and standards of excellence. The ministry also seeks to ensure that environmental concerns of the populace are considered in all aspects of national development.

#### **3.4.1.10 The Ministry of Housing, Lands and Maintenance**

The sole government entity responsible for the maintenance of buildings and infrastructure is the Ministry of Housing, Lands and Maintenance. The mandate of the ministry is:

*'To provide adequate shelter for all and to create home ownership for the majority of the population by providing the opportunity for the widest majority of Barbadians to own property'*

The ministry seeks to achieve its objective via the presence of a major instrument that governs the building and construction sector - the 1993 edition of the Barbados National Building Code. Updated in 2013, the Code is presently comprised of standards that seek to minimise risk. At present, there is no mandatory compliance to the Building Code. However, the Ministry of Transport and Works (MTW) is working towards the finalisation of the legal and administrative structure for its mandatory implementation. The overall objective of the Ministry of Housing and Lands is also exemplified in Goal 3: Building Social Capital of the Barbados National Strategic Plan which is associated with the following national targets as it relates to CC and DRM:

- Objective 1.1: Elimination of homelessness by 2025.
- Objective 1.2: Increase in home ownership by 10% per annum.
- Objective 1.3: A substantial increase in the construction of low- and middle-income houses by 2025.
- Objective 1.5: 100% access to all essential services - roads, drainage, water, electricity - for all homeowners by 2025.

### **3.4.1.11 The Barbados Police Force**

The Barbados Police Service<sup>211</sup> (BPS), as established under the Police Act of 1961(a), and the Constitution of Barbados is a part of the government responsible for local law enforcement. The RBPF is divided into three territorial divisions: (i) the Operations Support Division; (ii) the Administrative Support Division; and (iii) the Criminal Investigations Division. The organisation structure of the RBPF is modelled after London's Metropolitan Police Service.

### **3.4.1.12 The Barbados Coast Guard**

The officers and soldiers of the Defence Force serving as members of the Barbados Coast Guard shall:

- A. Enforce the provisions of every law relating to:
  - i. The regulation of any harbour or port of Barbados,
  - ii. Quarantine,
  - iii. Immigration,
  - iv. Fisheries,
  - v. Territorial Waters and Economic Zones,
  - vi. Safety at sea;
- B. Detect and prevent contravention of laws relating to revenue and customs; prevent persons from boarding, holding or clinging on to any vessel without the permission of the master of the vessel, and, if necessary, remove any such person from the vessel.

For the purposes of carrying out their duties, the members of the Barbados Coast Guard have the same powers, authorities and privileges as are conferred by law on members of the Police Force.

### **3.4.1.13 The Barbados Transport Board**

Formed on August 24th, 1955, this entity acts as the principal provider of safe, reliable and efficient mass transit services in Barbados. It aims to consistently deliver the highest level of customer satisfaction to users of public transport in Barbados. The Board continues to maintain a complete fleet inclusive of diesel powered and electric buses with wheelchair

facilities for the disabled. The Board retains three terminals across the island's Central Commercial Districts: Fairchild Street, Bridgetown; Princess Alice Highway, St. Michael and Speightstown, St. Peter. There is also a central staging depot is located at Mangrove, St. Philip and a sub-terminal at Oistins, Christ Church. The headquarters of the Barbados Transport Board are located at Roebuck Street in Bridgetown, St. Michael.

### **3.4.1.14 The Barbados Statistical Service**

The Barbados Statistical Service (BSS) plays a vital function in providing reliable and timely key economic and social statistics which are required by decision-makers and researchers. The duties of the BSS are:

- To take any census in Barbados;
- To collect, compile, analyse, abstract and publish statistical information relating to the social, agricultural, mining, commercial, industrial and general activities and conditions of the inhabitants of Barbados;
- To collaborate with departments of Government in the collection, compilation, analysis and publication of statistical records of administrations and departments; and;
- To organise a coordinated scheme of social and economic statistics relating to Barbados.

The BSS is governed by the Statistics Act 1958 (Cap.192) and operate in accordance with the following regional and international best practices:

- CARICOM Statistics Code of Practice
- United Nations Fundamental Principles of Official Statistics
- Principles Governing International Statistical Activities

These practices ensure that the BSS is operating at internationally accepted professional and ethical standards.

<sup>211</sup> Prior to Barbados becoming a republic in 2021, this entity was called the Royal Barbados Police Force (RBPF).

### **3.4.1.15 The Ministry of Transport, Public Works and Water Resources**

This ministry aims to provide efficient road network services, proper maintenance of Government building and vehicles, effective drainage solutions, special electrical services and public transportation. The objectives of the Ministry of Transport, Works and Water Resources are:

- To provide sound planning/policy advice and technical services in the areas of transport, works and electrical services.
- To provide a well-regulated and competitive environment for the land transport industry.
- To provide an excellent and safe technology driven, modern and efficient public transportation system.
- To provide a supply-driven integrated transport network infrastructure.
- To maintain and rehabilitate highways, tenantry and residential roads and other public accesses.
- To develop and maintain all government buildings, bridges, jetties and wharves and similar structures and other public assets.
- To develop, maintain and regulate road transport and ancillary facilities conducted through the Barbados Licensing Authority, the Transport Authority and private operators and the provision of ancillary services.
- To promote safety in all work relating to roads, public transport and electrical systems management.
- To regulate the traffic system in conjunction with the police.
- To support other Ministries and government agencies in the execution and implementation of projects.
- To provide effective standards and law enforcement and monitoring with integrity.
- To provide effective flood alleviation and mitigation solutions across Barbados.

### **3.4.1.16 The Town and Country Development Planning Department**

The Town & Country Development Planning Office (TCDPO) is the primary agency responsible for planning the use of land resources in Barbados. The TCDPO essentially facilitates the "orderly and progressive" development of land based on an approved National Physical Development Plan. The National Physical Development Plan is prepared by the Chief Town Planner and approved by the Minister responsible for planning.

### **3.4.1.17 The Ministry of Agriculture and Rural Development**

The Ministry of Agriculture and Rural Development has overall responsibility for agricultural development in Barbados. Its function is carried out through two divisions, Livestock and Crop, as well as through several specialized sections, such as the Agricultural Planning Unit, Plant Pathology Unit, Central Agronomic Research Station, Entomology, Land and Water Use Unit, Animal Nutrition Unit, Agricultural Stations, Soil Conservation Unit, and Veterinary Services.

### **3.4.1.18 The Barbados Agricultural Development and Marketing Corporation**

The Barbados Agricultural Development and Marketing Corporation (BADMC), formerly the Barbados Agricultural Marketing Company, was established in 1993 by the GoB. Charged with the responsibility to develop agriculture through innovative technological applications, technical and marketing research, and to create opportunities for investment that engenders enterprise, food security and prosperity in the agricultural sector, the BADMC performs the following functions:

- To develop agriculture and to operate and participate in such agricultural projects as the Minister may approve;
- To facilitate Government's policy with respect to rural development and land reform;
- To facilitate the development of agricultural programmes particularly among the youth;
- To foster co-operation in agricultural development between the public and private sector;

- To manage on a commercial basis such plantations and other agricultural land as may from time to time be vested in the Corporation in accordance with Government's agricultural policy;
- To stimulate and improve the production, marketing and processing of produce;
- To assist farmers in securing arrangements for the purchase, handling, transportation, exportation, shipping, marketing and sale of produce whether within or outside of Barbados;
- To promote the development of agricultural co-operative societies, including the marketing of their produce;
- To assist farmers in securing the most favourable arrangements for the storage of produce; and
- To make recommendations, on the request of the Minister, on any matter directly or indirectly related to the production and marketing of produce.

#### **3.4.1.19 The Fisheries Division**

This Division falls under the Ministry of Agriculture and Rural Development. This agency engages in fisheries planning and management. The Fisheries Resource Management Section of this Division provides scientific information for planning and implementing measures for fishery management and development, including:

- Catch and effort statistics;
- Biological, social and economic information;
- Fisheries management measures;
- Computer management;
- Aquaculture and mariculture; and
- Library service

#### **3.4.1.20 The Barbados Marine Trust**

This Trust, which was formed in 2000, is dedicated to promoting the environmentally and socially sustainable use of Marine Areas of Barbados. The

members of the group include diverse stakeholders such as fisherfolk, dive operators, hoteliers, water sports operators, businesses and the local community. The trust not only assists the government in the implementation of marine management initiatives, but also intends on implementing a Long Term Plan to increase educational awareness about the importance of marine resources.

#### **3.4.1.21 The Barbados National Trust**

This charitable, non-profit organization was founded in 1961 and is responsible for the preservation of the unique cultural heritage of Barbados for future generations. Its mission and vision are based upon the National Trusts of England and Australia. The following historical buildings and sites are managed by the Barbados National Trust:

- Andromeda Botanical Gardens
- The Arbib Nature and Heritage trail
- Gun Hill Signal Station
- Morgan Lewis Sugar Mill
- Sir Frank Hutson Sugar Museum and Factory
- The Bridgetown Synagogue
- Tyrol Cot Heritage Village
- Welchman Hall Gully
- Wildey House

#### **3.4.1.22 The University of The West Indies, Cave Hill Campus**

This tertiary institution assists in the management and monitoring of biodiversity in Barbados. Academics, mainly from the Department of Biological and Chemical Sciences and the Centre for Resource Management and Environmental Studies (CERMES), advise Government and the private sector on biodiversity issues, and also conceptualise and develop sustainable environmental projects. The university also offers environmental science and management degrees at the undergraduate and postgraduate levels.

### 3.4.1.23 The Bellairs Research Institute

This Institute was established as a marine research facility in Barbados in 1954. It is owned by McGill University in the city of Montreal, Canada. The Institute's goal is to provide scientists with high quality tropical laboratory and field facilities in the Caribbean.

### 3.4.3 Local Level

District Committees are categorized by geographical location and oversee community mobilization in support of the national disaster management efforts. In Barbados, there are sixteen (16) Standing Committees which are responsible for planning the emergency response functions at the national and local levels under the purview of their respective thematic areas. Further details regarding these standing committees are outlined in Appendix V.

### 3.4.4 Community Level

To be effective, disaster risk reduction requires a bottom-up approach. With effects usually felt at the individual and community level, localities must be involved in disaster risk reduction planning. Across Barbados, there are thirty (30) District Emergency Organizations (DEOs) which coincide with the thirty (30) political constituencies (as seen in Appendix VI). The DEOs act as a primary vehicle for the execution of the National Community Preparedness Programme; and represent the voluntary arm of the National Emergency Management System (NEMS). DEOs also organise and coordinate community resources for an effective response during crises. Such organizations also work closely with their communities to develop and to implement disaster prevention and preparedness programmes in efforts to reduce the extent of the impacts posed by hazards<sup>212</sup>. A photograph of a segment of the Barbadian volunteers is seen below.

Figure 54: Some Members of a District Emergency Organization in Barbados



Source: The Department of Emergency Management

The volunteer registry currently stands at 942 across all political constituencies. The membership base is comprised of local residents from respective communities which they are intended to serve. All segments of the resident population are encouraged to join: churches, service clubs, neighbourhood watches, Parent-Teacher Associations (PTAs), skilled artisans, families, community groups, non-governmental organisation and most importantly the individuals living within the community. There is also a close association with critical government agencies. These include the Barbados Fire Service and the Barbados Police Force

212 This includes floods, hurricanes, fire, earthquakes and or vehicular accidents.

that have retained branches in close proximity to the respective communities. The DEOs therefore facilitate a community volunteer movement by affording the general population with the opportunity to participate in the national disaster management system. Typically, a DEO is composed of a Chairman, a Deputy Chairman, a Secretary, a Public Relations Officer, and various officers covering key thematic areas. These include: Shelter Management, First Aid, Information and Damage Assessment, Road Clearance, Transportation, Communication, Clothing and Feeding. The main functions of the DEOs are:

- To provide a forum for education and training at the Community level;
- To develop a mechanism for initial emergency response and;
- To develop a mechanism to facilitate the conduct of damage assessment, needs analysis and relief distribution.

Care is taken to ensure that the inherit skillset of its general members is aligned to the tasks and functions given. This action seeks to ensure that members are involved in areas that are of interest to them and for which they possess the desired level of proficiency and or competency.

To complement the efforts of the DEOs, civil society renders support to response operations by providing emergency telecommunications and surveillance support via drones and other operations. Such entities include the Barbados Citizens Band Association (BCBRA); the Amateur Radio Society of Barbados (ARSB) and the Barbados Red Cross Society (BRCS). Media coverage has also been critical to the national disaster management mechanism, as a core stakeholder in the communications strategy, facilitating education and advocacy as well as crisis and emergency communications. Academic institutions like the University of the West Indies – Cave Hill Campus in Barbados support research and knowledge building efforts. Charitable non-profit organisations have also been instrumental in providing logistical support during emergencies and disasters via formalized arrangements. For instance, auxiliary bodies like the Roving Response Team (RRT) often lend support to emergency efforts. In light of these efforts, such entities therefore act as multipliers and enablers of national efforts thereby facilitating island-wide coverage.

# Synergies in Policy Coherence across National and International scales

## Chapter 4 Overview

This chapter examines the extent of synergies in policy coherence on the national and international scales across different dimensions. This is achieved via a review of internationally agreed policies and objectives like the Sendai Framework on Disaster Risk Reduction, the Paris Agreement on Climate Change and the Sustainable Development Goals with nationally approved initiatives. The extent to which policy coherence is largely consistent with the international agreed objectives emphasizes Barbados' high degree of political will and transformational thinking. Even with this heightened awareness of the prevalence of hazards (whether climate-related or man-made) at the national level, there needs to be a demonstrated level of political will at the international level to address the consequences of disaster risk – particularly within the SIDS context regarding loss and damage, adaptation and mitigation.

### 4. Policy Coherence

This section provides an overview of the policy coherence framework in Barbados. This is achieved via the analysis of the main national policy instruments for development, climate change adaptation and disaster risk reduction (as previously discussed in Section 3.3 and Section 3.4), alongside the three governing international frameworks within these thematic areas: The Sustainable Development Goals, the Paris Agreement on Climate Change and the Sendai Framework for Disaster Risk Reduction. The main policy instruments analysed for Barbados include:

- The National Strategic Plan of Barbados (NSP)
- The Physical Development Plan (PDP);

- The Barbados Roofs to Reefs Programme (R2RP);
- The Barbados Comprehensive Disaster Management (CDM) Policy (2022);
- The Barbados Country Work Programme (2019-2023);
- The Government of Barbados' Second National Communications (SNC) to the UNFCCC (2018);
- The Government of Barbados' Intended Nationally Determined Contributions (INDC) to the UNFCCC (2015);
- The Government of Barbados' Updated Nationally Determined Contributions (NDC) to the UNFCCC (2021);

Policy coherence has been defined by GIZ (2019)<sup>213</sup> as:

*"The approach and deliberate processes and actions within a country to integrate – as appropriate – the implementation of the Sustainable Development Agenda, Sendai Framework for Disaster Risk Reduction and the Paris Agreement; in order to increase efficiency, effectiveness, and the achievement of both common (e.g., resilience) and respective goals"* (GIZ, 2019, p. 7).

The extent of policy coherence displayed within a given country context can be instrumental in identifying key policy gaps and offering lessons

<sup>213</sup> GIZ. 2019. "Guidance Note: Coherence Concepts and Practices. Global Initiative on Disaster Risk Management, Regional Consultative Committee on Disaster Management (RCC), Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ)".

for the future - not only for the GoB but also other national governments and regional actors. It can also act the basis for future work in supporting coherent Sustainable Development Goals (SDGs)-Disaster Risk Reduction (DRR)-Climate Change Adaptation (CCA) approaches in the context of the 2030 Agenda for Sustainable Development.

The prevalence of greater coherence between DRR and CCA actions not only ensures that the development gains achieved thus far are protected from the impact of disasters and climate change but also contributes to and ensures the realization of better developmental outcomes that neither create new or exacerbate existing and future levels of risk. In addition to this, such coherence also seeks to strengthen national leadership and promote greater institutional strengthening. Ultimately, greater policy coherence seeks to enhance and to foster greater transparency at the implementation level with the overall objective of leveraging synergies and mutually beneficial opportunities across policies to facilitate comprehensive disaster and climate risk management.

The extent of policy coherence (for example: substantial, partial, or no coherence) displayed between the SDGs, DRR and CCA in national planning and policy instruments for Barbados was determined using for the following six themes under policy coherence.<sup>214</sup>:

1. **Strategic coherence:** Reviews whether DRR and CCA are explicitly addressed jointly or if there is an aim to strengthen the relationship and linkages between the two fields.
2. **Conceptual coherence:** Explores how countries link DRR and CCA conceptually - in particular through the concepts of risk and resilience.
3. **Institutional coherence:** Analyses whether the coordination between DRR and CCA is envisioned, as well as if and how institutional arrangements support coherence.

4. **Operational coherence:** Reviews measures, actions and activities which cumulate DRR and CCA practices and underscore to what extent planning is considered as cross-sectoral.
5. **Financial coherence:** Explores whether and how funding strategies, financing and investments frameworks cumulate DRR and CCA.
6. **Monitoring, Evaluation and Reporting (MER) coherence:** Reviews the extent to which MER mechanisms cumulate coordination and synergies between the SDGs, DRR, and CCA.

#### 4.1 Strategic Coherence

This section analyses the extent of strategic coherence within national policy instruments for development, climate change adaptation and disaster risk reduction. The National Strategic Plan (NSP) of Barbados (2006-2025) represents the overarching goal for the future sustainability of the Barbadian economy. It provides the blueprint for the realization of Barbados' vision of becoming a fully developed society by the end of the first quarter of this century. Goal Four of the NSP advocates the building of a green economy which requires the protection, preservation and enhancement of our physical infrastructure, environment, and scarce resources to advance social and economic development. To fulfil this ideology, the Barbados' Physical Development Plan (PDP) codifies the land-use development areas and supporting policy goals and objectives. Accordingly, the PDP acts as an important instrument in enabling the implementation of adaptation strategies that promote climate change resilience in public and private developments. Scheduled reviews and updates of the Plan are informed by national growth and development strategies, vulnerability studies and risk assessments as well as extensive public and private sector consultations. The overall strategic coherence of the PDP between SDG, CCA and DRR is partial because the SDGs are not integrated with CCA and DRR, instead CCA and DRR are fully integrated. In fact, the PDP recognizes the need to consider climate change in all governmental and private sector planning processes to ensure that capacity building in the realms of adaptation and resilience becomes a mandatory feature of all socio-economic, sectoral, and environmental

<sup>214</sup> The UNDRR analysis on policy coherence was conducted for 16 selected countries of the Caribbean Region: Antigua and Barbuda, The Bahamas, Barbados, Belize, Cuba, Dominica, Dominican Republic, Grenada, Guyana, Haiti, Jamaica, Saint Kitts and Nevis, Saint Lucia, Saint Vincent and the Grenadines, Suriname, and Trinidad and Tobago. These countries were selected because UNDRR and the Caribbean Disaster Emergency Management Agency (CDEMA) have been supporting them in the development of their Country Work Programmes (CWPs).

development planning processes. In this way, DRR and CCA will be mainstreamed into development and programming cycles. This will allow disaster risk management to complete its transformation from short-term relief and response interventions towards becoming a central element in the development process. Where required, planning decisions are informed by environmental impact assessments that also address climate change concerns. The PDP is currently under review and through this process, climate change vulnerability, adaptation and mitigation will be extensively considered for further integration into the national development planning.

As the operational arm of the Barbados' Physical Development Plan, the Barbados Roofs to Reefs Programme (R2RP) represents a holistic initiative adopted by the GoB in 2021. The programme seeks to integrate mitigation and adaptation climate concerns with a social policy geared towards improving the standard of living and quality of life for all - particularly the most vulnerable segments of the population of Barbados. The programme also supports improved infrastructure resilience to hydrometeorological hazards such as tropical cyclones. The R2RP facilitates an avenue through which public investment will be directed. With a strong participation by the Ministry for Economic Affairs and Investment, the R2RP aims to improve the resilience of the housing stock and access to water and sanitation whilst eradicating pit toilets and promoting the use of solar and other green energy options to reduce dependence on fossil fuels. The R2RP also seeks to address direct line electricity transmission, to improve water quality, and to reduce the volumes and impacts of solid waste and sewage. These efforts are expected to lead to better living conditions and environmental protection across terrestrial and marine environments.

There is substantial strategic coherence within the Government of Barbados' Intended Nationally Determined Contributions (INDC) submission to the UNFCCC in 2015 as well as its Updated Nationally Determined Contributions (NDC) submission to the UNFCCC in 2021. The NDC explicitly recognizes the importance of international and regional frameworks and seeks to achieve direct alignment with these initiatives. International frameworks include the Sustainable Development Goals, the Paris Agreement on Climate Change and the Sendai Framework for Disaster Risk Reduction. Whilst regional frameworks to promote disaster resilience include the Caribbean Resilience Framework as

well as the Comprehensive Disaster Management Strategy. The island's INDC recognizes that the climate change risk profile of Barbados is dominated by coastal and weather effects. These include sea level rise; storm surges; increased tropical storm and tropical cyclonic intensity and frequency; as well as slow-onset environmental impacts like flooding and droughts. The latter slow onset impact highlight the importance of a specifically nuanced issue for Barbados because the country already suffers from water scarcity and changes in rainfall patterns exacerbate the prevalence of droughts considerably.

There is substantial strategic coherence within the Barbados Country Work Programme (CWP) 2019-2023 which recognizes that managing disaster risk and building a resilient society is of paramount importance to maintaining a trajectory of continued sustainable development. Given these considerations, the Barbados CWP represents a strategy and action plan for addressing disaster risk. It utilizes a comprehensive, inclusive and results-focused approach. Firstly, the Barbados CWP outlines the nature of disaster risk for the country. It later summarizes the process through which the CWP was developed and highlights the cross-cutting themes (climate change, gender responsiveness, information and communication technologies (ICTS) and environmental sustainability) and the guiding principles for implementing the CWP (as seen in Section 3.3.1). Retained within the CWP is a Logical Framework. In addition to this, the CWP refers to the desired results (Outcomes and Outputs) that are targeted for achievement within different programmatic areas. Lastly, the CWP provides an outline for the Monitoring, Evaluation & Reporting (MER) mechanisms for the CWP. Within the CWP, references to SDGs and CCA are largely broad and high level without efforts made to specifically addressing them in more detail. Even though the CWP mainly address DRR, it refers to SDGs in very broad sense and the promotion of a climate resilient country. However, the CWP does not provide vision/goals/principles to address CCA. The CWP is mainly focuses on DRR and does not jointly address the SDG and CCA. This realization seeks to promote the integration of DRR into other sectors with a specific Outcome 2.2 (Comprehensive Disaster Management (CDM) mainstreamed into key sectors) and Outputs.

## 4.2 Conceptual Coherence

This section analyses the extent of conceptual coherence within national policy instruments for development, climate change adaptation and disaster risk reduction. It examines how national policy instruments link the SDGs, climate change adaptation and disaster risk reduction conceptually through the concept of risk and resilience which is defined as:

*“The ability of a system, community or society exposed to hazards to resist, absorb, accommodate, adapt to, transform and recover from the effects of a hazard in a timely and efficient manner, including through the preservation and restoration of its essential basic structures and functions through risk management.”*  
(UNDRR, 2012)

There is substantial conceptual coherence within the National Strategic Plan (NSP) of Barbados (2006-2025). This strategic plan embodies the theme “Global Excellence, Barbadian Traditions”. In pursuit of the national vision for 2025, the NSP encompasses the following six (6) goals based upon the inspirational words of the Barbadian National Anthem. The NSP is also predicated upon the development and integration of Sectoral Strategic Plans, policies and initiatives:

- **Goal 1:** “Inspired, exulting, free”: Unleashing the Spirit of the Nation;
- **Goal 2:** “Firm craftsmen of our fate”: New Governance for New Times;
- **Goal 3:** “Strength and unity”: Building Social Capital;
- **Goal 4:** “These fields and hills”: Strengthening the Physical Infrastructure and Preserving the Environment;
- **Goal 5:** “Upward and onward”: Enhancing Barbados’ Prosperity and Competitiveness; and
- **Goal 6:** “Strict guardians of our heritage”: Branding Barbados Globally.

Goal 1 of the NSP highlights the significance of a cultural transformation that will not only reinforce Barbadian values and national identity, but also act

as a catalyst for propelling Barbados into the 21st century as a fully developed society. This goal will seek to create greater equity and social justice, whilst building an inclusive society with opportunities for all.

Goal 2 of the NSP advocates for improved governance. It envisions a society that is free of all vestiges of colonialism - with a modernized parliamentary and electoral system. Such mechanisms would not only seek to enhance political participation of the populace, but also the empowerment of all communities. Achieving Goal 2 requires a transformational change within the current administrative mechanisms whilst being cognizant of the important role of civil society. Further, the goal envisages that there will be higher levels of self-reliance, less dependency on the state and greater diversity and tolerance.

Goal 3 of the NSP emphasizes the importance of an ‘All-of-Society’ approach within the development process via promoting social capital. This capital involves the development of the human resources necessary to function in a dynamic knowledge-based services economy to facilitate the creation of appropriate family and community values. Achieving Goal 3 calls for a revolution within the current educational systems across all spheres to unlock the productive potential of all Barbadians. Ultimately, a good quality of life is paramount. To promote healthy lifestyles, a well-developed public health system is essential. In addition to this, the eradication of poverty from our social landscape will all be part of this social transformation.

Goal 4 of the NSP advocates for the building of a green economy. It thereby highlights the importance of achieving a nexus between the economy, the society and the environment - particularly as it relates to water, food and energy securities, the built environment and transportation.

Goal 5 of the NSP seeks to enhance Barbados’ Prosperity and Competitiveness at the regional and global levels. Achieving such will require dynamic and transformation changes in the way in which we conduct economic activities. Identifying viable and competitive ventures that can contribute to sustainable growth, employment opportunities and overall prosperity for everyone is paramount. Achieving this goal requires a concerted focus on the exportation of services like tourism and international business, whilst exploiting new avenues such as culture and health, that will all contribute to a more diversified and prosperous economy.

Goal 6 of the NSP calls for the consolidation of the Barbadian image on the global stage. Standing on the laurels of the island's political stability, educational systems, democratic governance and good leadership – which have all earned for Barbados worldwide recognition.

There is substantial conceptual coherence within the Barbados' Physical Development Plan. Within the PDP, conceptual coherence is largely addressed between CCA and DRR through the concept of risk. The PDP also recognizes that development on the island acts as a possible risk factor. The word resilience is mentioned within the document but does not represent a central theme of the plan. In addition to this, the PDP does not provide a definition of resilience. DRR and CCA share the common goal to reduce national and community vulnerability and to contribute to climate resilient development in light of climate variability and climate change. The latter of which can alter the frequency, intensity, duration, timing, spatial distribution and extent of severe weather events to which the island is exposed and thereby increase the associated risks.

There is substantial conceptual coherence within the Barbados Country Work Programme. While the CWP is primarily centred around disaster risk, it does recognize that CC can induce more extreme and frequent events. However, the CWP elaborates on the extent of the synergies between DRR and CCA to facilitate the development processes of the country. The root causes of inefficient and ineffective processes within the National Emergency Management System were explored. These were assessed in terms of the system's capacity to DRM and not with respect to specific hazards or vulnerabilities. In particular, the results from the Situation Analysis demonstrated that the Mitigation and Recovery phases of the disaster cycle were deemed as the lowest scoring areas and therefore required particular attention. Similarly, the Recovery phase was deemed as having the lowest performance rating overall. The CWP integrates considerations for the following four cross-cutting themes: (i) Climate Change; (ii) Gender Responsiveness; (iii) Information and Communication Technologies (ICTs); and (iv) Environmental Sustainability. However, the CWP does not provide any further elaboration on Gender Responsiveness within the document. This therefore signifies the importance of defining the linkage within sustainable development, CCA and DRR by placing resilience at the centre of development through a gender lens. Maintaining and improving public-private engagements across

various stakeholder groups particularly via the Global ARISE initiative also seeks to strengthen this resolve.

In recognition of the challenge posed in addressing loss and damage, the GoB has referred to Article 8: Decision 1 of the Paris Agreement<sup>215</sup>:

*"Parties recognize the importance of averting, minimizing and addressing loss and damage associated with the adverse effects of climate change, including extreme weather events and slow onset events, and the role of sustainable development in reducing the risk of loss and damage".*  
(UNFCCC, 2015)

This stance has been reaffirmed within the Mitigation section of the Barbados' 2021 Update of the First Nationally Determined Contribution to the UNFCCC<sup>216</sup>. This document was submitted in fulfilment of the country's obligations under the Paris Agreement on Climate Change. The aim of the Mitigation section seeks to achieve:

*"Coherence between national development priorities and climate goals is key, as this enables maximizing the benefits of early action. A resilient economy is a precondition for Barbados' development. For Barbados, resilience bridges the mitigation-adaptation divide, seeking to prevent negative climate change impacts through a sustainable transformation of economic and social systems".*  
(Government of Barbados, 2021, p. 13)

### 4.3 Institutional Coherence

This section analyses the extent of institutional coherence within national policy instruments for development, climate change adaptation and disaster risk reduction. It explores whether coordination between the sustainable development agenda, climate change adaptation, and disaster risk reduction is envisioned, and if or how institutional arrangements can support coherence.

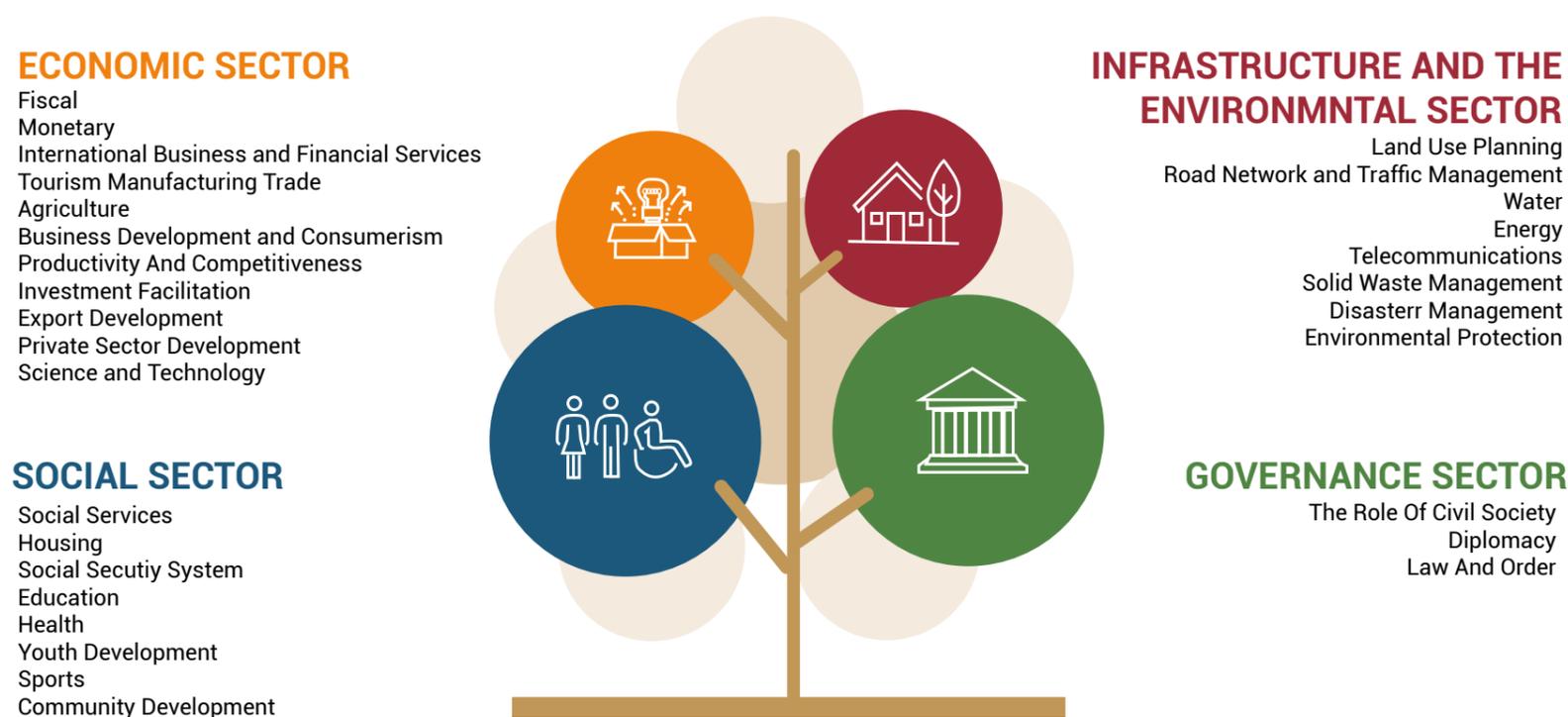
There is institutional coherence within all national instruments. For instance, the National Strategic Plan for Barbados represents a holistic approach

<sup>215</sup> Article 8 of the Paris Agreement and Decision 1/CP.21 Paragraphs 48–52 (FCCC/CP/2015/L.9/Rev.1.)

<sup>216</sup> Government of Barbados. 2021. "The Barbados 2021 Update of the First Nationally Determined Contribution"

to national development by ensuring the future sustainability of the Barbadian economy. The NSP encompasses all Government Ministries, Departments and Statutory Bodies, the private sector, labour and the civil society. As seen in Figure 55, the NSP includes the formulation of the various sectoral objectives and strategies under the governance, economic, social, infrastructure and environmental sectors. In the case of the latter sector, great emphasis is placed upon the following thematic areas: (i) Land Use Planning; (ii) Road Network and Traffic Management; (iii) Water Security; (iv) Energy Security; (v) Telecommunications, (vi) Solid Waste Management; (vii) Environmental Protection; and (viii) Disaster Management.

**Figure 55: The Sectoral Objectives and Strategies under the Barbados National Strategic Plan**



Source: The National Strategic Plan of Barbados, 2006-2025

With the overall objective of creating appropriate disaster management systems in collaboration with the National Disaster Office (the Department of Emergency Management), strategies under the thematic area of Disaster Management include:

- **Strategy 1.1:** Develop a comprehensive disaster management plan for the personal social service agencies;
- **Strategy 1.2:** Form and train disaster preparedness committees;
- **Strategy 1.3:** Formulate procedures to activate disaster management plans;
- **Strategy 1.4:** Ensure that there is further collaboration between Government and NGO disaster agencies; and
- **Strategy 1.5:** Enhance the Barbados Meteorological Service to enable it to make better forecasts and inform the public in a timely manner.

Under the PDP, reference is made to several Priority Sectors and Cross Cutting Areas. These include: (i) the Tourism, Agricultural and Transportation Sectors; (ii) Water and Sewage Issues; (iii) Solid Waste Management; (iv) Alternative Energy Development; and (v) Green Spaces. Cognizant of the cross sectoral

nature of many objectives detailed within the PDP (see Section 3.3.1.3), there is an urgent need for maximum coordination and collaboration amongst various government entities, the public sector, civil society and the general public to promote a transformational change in the overall governance mechanism. To date, overall institutional coherence is somewhat lacking. In fact, the PDP only identifies key tools to assess proposed development projects. These include four (4) types of impact assessments, namely:

1. Environmental and Social Impact Assessments (ESIA);
2. Heritage Impact Assessments (HIA);
3. Agricultural Impact Assessments (AIA); and
4. Traffic Impact Assessments (TIA).

Within the limitation highlighted in the Conceptual Coherence section, the CWP identifies the roles and responsibility of DRR. In particular, it defined the National Emergency Management System (NEMS) as broad-based multi-sector, multi-stakeholder mechanism that is coordinated by the Department of Emergency Management (DEM). However, the CWP does not directly refer to the coordination mechanisms that promote sustainable development. Such mechanisms would seek to strengthen coherence but in their absence would undermine those sustainability efforts made to ensure that the CWP is congruent with national, regional, and international initiatives and that would directly contribute to the realization of Barbados' goals and objectives with respect to these initiatives. At sub-national level, the GoB recognizes the important role played by society. This is emphasized via a bottom-up approach which underscores that the resilience of communities forms the bedrock of a nation's resilience. Across Barbados, there are thirty (30) District Emergency Organizations (DEOs) which coincide with the thirty (30) political constituencies (as seen in Appendix VI). The DEOs act as a primary vehicle for the execution of the National Community Preparedness Programme; and represent the voluntary arm of the NEMS.

There is a general paucity of national policy instruments that directly address to climate change. Other than the Draft National Climate Change Policy Framework, most policy instruments collectively address sustainable development, CCA and DRR to varying degrees. At the national level, there have been various initiatives to promote the importance of climate change to a Small Island Developing State like Barbados via the pursuit of the Green Economy

and the Blue Economy. In light of such efforts, institutional arrangements need to be strengthening to minimize the instances of duplication across ministries and departments and to minimize the existence of extensive bureaucratic red tape. The continuation of climate resilient efforts on the island will seek to ensure that an all-encompassing all-of-society approach is adhered to facilitate full stakeholder buy-in at the national and sub-national levels.

#### 4.4 Operational Coherence

This section analyses the extent of operational coherence within national policy instruments for development, climate change adaptation and disaster risk reduction. The 2030 Agenda for Sustainable Development presents an opportunity for Small Island Developing States. This agenda allows SIDS to optimize the potential benefits of implementing the 17 Sustainable Development Goals; and to enhance the capacity of national frameworks. The latter of which seeks to guide coherent policy design and to promote the cross-sectoral integration and ultimately implementation of national development objectives.

Barbados utilizes targeted policy formations as well as a monitoring mechanism to gauge the progress of national goals, objectives and initiatives in terms of efficiency and effectiveness. This thereby seeks to ensure that the entire Barbadian populace is highly engaged and benefit from national development efforts – in particular vulnerable and disadvantaged groups like women, children, the elderly and the disabled community. This measure seeks to ensure that actual development 'leaves no one behind'.

Various environmental protection policies, laws and management programmes reaffirm Barbados' commitment to achieve sustainable development. Retained within various national and sectoral policies is a comprehensive list of climate change impacts, adaptation options over varied time scales, proposed priority areas as well as current and potential barriers within the adoption and implementation phases of initiatives within the priority sectors (as seen in Appendix VII). Several of these national and sectoral policies that are particularly relevant and influential in shaping the national climate change response are explicitly mentioned in this document. Furthermore, the COVID-19 crisis also revealed the strong connectivity between development, public health, food security, education and tourism.

The NSP strongly acknowledges the link between development, CCA and DRR. To ensure operational coherence, this plan is implemented by the Ministry of Finance and Economic Affairs in conjunction with Government Ministries, Departments and Statutory Bodies, the private sector, labour and civil society. The NSP involves the development of periodic sectoral strategic plans over five-year intervals to help shape revisions to the National Strategic Plan. These sectoral plans and their associated amendments seek to not only consider the views of different stakeholders across the private sector, labour and civil society but also changing dynamics in the economy, society and the environment. To promote greater public awareness and education, all citizens of Barbados will be made aware of the content of the NSP via various avenues. These include print and electronic media, lectures and seminars, and town hall/community meetings.

Similarly, the PDP strongly recognizes the correlation between CCA and DRR as centrally identified core assets of Barbados. Such assets include: fresh water resources, agriculturally productive land; natural heritage systems; cultural heritage sites; the Barbados National Park and Reserve; and green spaces within communities across Barbados. In particular, the recognition of natural heritage systems as core assets substantially integrates CCA and DRR at the national level. Furthermore, the PDP identifies specific opportunities to enhance partially cohesion. This includes raising awareness of CCA and DRR initiatives and establishing a multi-purpose database. Jointly these two opportunities, if taken, will substantially improve coherence via climate and disaster risk assessments and promoting ecosystem-based approaches.

Within the limitation highlighted in the Conceptual and Institutional Coherence sections, the CWP promotes actions and activities which bring together SDGs, CCA, and DRR practices and cross-sectoral planning. In particular, research and knowledge management is deemed as an area of vital importance to build resilience and therefore cannot be neglected. Priority 4 of the CWP addresses an area of relative weakness – the generation of data and information as well as its effective integration into decision-making processes. The aim of Priority 4 seeks to improve knowledge management holistically by increasing and sustaining disaster management research and knowledge transfer. The Outcome 2.2 of the Barbados CWP calls for CDM mainstreaming within key sectors. If achieved, Outcome 2.2 seeks to better integrate disaster

risk management into traditional sectors such as Agriculture, Health, Education and Tourism and emerging sectors (with focus on climate finance, green and blue economies, the energy sectors, and the private sector). The NEMS will work with key strategic partners within each of these sectors to build and maintain their capacities for disaster mitigation, preparedness, response and recovery. In addition to this, this collective action will seek to implement initiatives that build resilience within the respective sectors, utilizing existing knowledge of hazards, vulnerability and risk.

#### 4.5 Financial Coherence

This section analyses the extent of financial coherence within national policy instruments for development, climate change adaptation and disaster risk reduction. It explores whether and to what extent funding strategies and investments bring together the sustainable development agenda, climate change adaptation and disaster risk reduction. Such coherence thereby allows for the mobilization and reassignment of funding across these thematic areas. More importantly, it seeks to ensure the maximization of limited financial resources – a prevalent occurrence within the SIDS context.

Across the diverse range of documents analysed, there is limited financial coherence. The only applicable reference of financial coherence is related to DRM. There is demonstrated by the existence of a comprehensive list of different fund programmes and projects that are largely associated with adaptation/DRR as well as mitigation<sup>217</sup>.

The NSP provides insights into the extent of financial resources required to fulfil the overall vision for Barbados by the year 2025. It declares that a substantial amount of public expenditure will be required to execute the strategies, programmes and projects over the NSP's specified period. Fulfilment of the nation's vision will therefore require the island to not only establish and to maintain partnerships with the private sector but also to develop and implement Memorandum of Understandings with several bilateral, regional and multilateral partners in an effort to derive a significant proportion of the financing required by 2025. However, the NSP does

<sup>217</sup> An example of a climate resilient project is the Water Resource Management and Flood Resilience Climate Change Programme. This project is funded via assistance from the United States Agency for International Development.

not explicitly state nor provide an estimate for the level of funding required.

The PDP does not include any references to funding mechanisms or structures that collectively address SDGs, CCA and DRR. This represents a shortcoming of the document which primarily seeks to provide a clear and accessible framework for private and public investment in the physical environment without explicitly referring to an estimation budget.

The CWP makes general references to an insurance scheme but in limited detail. However, related key activities involve the development of a Catastrophe and Risk Insurance product for chattel houses, crops and fisheries. Instead, the INDC documents strongly refer to the insurance sector. Barbados' insurance industry is fairly advanced compared to those that exist within most emerging economies. This reflects the recognition of the island's high exposure to natural hazards as well as the high vulnerability of key sectors. In particular, the tourism industry requires vast insurance coverage to protect its capital investments.

Barbados is a member of several regional Credit Funding Facilities. For instance, the Caribbean Catastrophe Risk Insurance Facility (now CCRIF-SPC) - the world's first index-based, multi-country catastrophe insurance pool established in 2007 (CCRIF-SPC, 2013). In 2010, GoB received a pay out of USD \$8,560,247.00 (BBD \$17,120,494.00) from the CCRIF within fourteen (14) days following the passage of Tropical Cyclone Tomás. In 2020, Barbados joined the Inter-American Development Bank's Contingent Credit Facility for Natural Disaster Emergencies (CCF). Established in 2009, the IDB created the CCF in an effort to provide a financial safety net for all IDB's borrowing member countries<sup>218</sup> in times when they need it most. Recognized as one of the IDB's main tools, the CCF helps countries to develop effective strategies for disaster financial risk management via the cash provisions following a disaster of severe to catastrophic proportions for humanitarian relief and to restore basic services. The coverage limit of the CCF per country is up to US\$300 million or 2% of the borrowing member country's GDP, whichever is less, with disbursements contingent to the occurrence of a disaster event in a certain locality and intensity previously agreed with the Bank.

218 Eligibility requirements are contingent on the existence of a Comprehensive Natural Disaster Risk Management Program (CDRMP) approved by the IDB. The CDRMP includes measures on governance, risk identification, risk reduction emergency preparedness and response, and financial protection and risk transfer. The CDRMP also has measurable output and annual indicators to allow for regular monitoring.

The GoB also retains a national Catastrophe Fund with an approximate balance of USD \$20 million. This fund was established to assist homeowners whose dwellings are deemed as uninsurable. The fund is solely financed by contributions to the National Insurance Scheme.

Insurance products are deemed as more effective when they are coupled with reward risk reduction measures. Noting such, Barbados is considering a variety of insurance options that can be used to support enhanced climate resilience. The prospective instruments include:

- Sovereign disaster risk transfer;
- The Inter-American Development Bank's Contingent Credit Facility (CCF);
- Amendments to the Catastrophe Fund;
- Agricultural insurance;
- Property catastrophe risk insurance;
- Disaster micro-insurance to protect low-income households; and
- Health insurance.

The Barbadian Prime Minister, The Right Honourable Mia Amor Mottley, Q.C., M.P., delivered her opening remarks<sup>219</sup> on November 7th, 2022 at the COP27 World Leaders Summit in Sharm El-Sheikh, Egypt. She highlighted the high ambition of SIDS to ensure good developmental outcomes despite their unique and differentiated challenges. The inability to deliver on this high ambition is directly correlated to the pre-existing global industrial strategy and financial mechanisms. She later condemned the financial constraints faced by the Global South to fight climate change and to address disaster risk.

#### 4.6 Monitoring, Evaluation and Reporting Coherence

This section analyses the extent of monitoring, evaluation and reporting coherence within national policy instruments for development, climate change adaptation and disaster risk reduction.

219 United Nations Climate Change. 2022. "Mia Mottley, Prime Minister of Barbados at the Opening of the #COP27 World Leaders Summit". <https://www.youtube.com/watch?v=5J0egwAf00w>.

The implementation of the NSP includes a monitoring, evaluation and reporting mechanism. The national plan is monitored by the Ministry of Finance and Economic Affairs which assumes overall responsibility for ensuring that the review, monitoring and implementation of the goals, objectives, strategies and targets are effectively undertaken. This ministry has therefore been strengthened by the creation of a special unit whose mandate is to oversee the implementation of the National Strategic Plan. In addition to this, the National Economic Council, with expanded membership, provides the overall oversight and guidance. Ultimately, the NSP will be updated to not only consider the views of the private sector, labour and civil society but also changing dynamics in the economy, society and the environment.

The implementation of the PDP includes a monitoring, evaluation and reporting mechanism. However, there limited details regarding the operationalization of this mechanism in terms of specific objectives and targets were divulged. The PDP recognizes the importance of an ongoing monitoring, evaluation and reporting mechanism since the proposed objectives and policies retained within the PDP are based upon scenarios and assumptions that are highly subject to change over time. The monitoring framework therefore needs to identify emerging trends and related issues; to analyze the overall effectiveness of the Plan and its policies; and to facilitate adjustments and updates, where deemed necessary.

To facilitate greater stakeholder buy-in of the CWP, a national stakeholders meeting was convened. Stakeholders later agreed to establish a Monitoring, Evaluation and Reporting (MER) mechanism for the CWP. This mechanism will be augmented by periodic assessments such as the CDM Audit. Stakeholders also selected useful indicators for measuring success; proposed targets for those indicators and timeframes; and designated responsibilities for leading and supporting the implementation of such activities. Most indicators were selected from a Basket of Indicators - a set of Impact, Outcome and Output indicators collated for CWP development. Such indicators are linked to regional and international strategies and frameworks such as the Sendai Framework on Disaster Risk Reduction, the SDGs, the Caribbean Community (CARICOM) Strategy 2015-2019 and the Regional CDM Strategy and Results Framework 2014-2024.

The Monitoring, Evaluation and Reporting (MER) mechanism will involve the following elements:

- An electronic tool for tracking CWP progress will be created, based on widely accessible, low-cost applications;
- Quarterly progress updates will be shared electronically with the NEMS;
- An annual MER consultation will be held at the start of each year of the CWP to review progress, identify challenges and lessons and make recommendations to improve implementation; and
- CWP Annual reports on progress will be presented to the EMAC.

The Barbados NDC submissions embody efforts to reduce national emissions and adapt to the impacts of climate change. In this regard, the Monitoring, Evaluation and Reporting (MER) mechanism will require a centralized platform to support a diverse range of stakeholders and end users. The development of a reliable platform that adopts a standardized methodology would not only ensure greater data integrity within the operational and policy space but also facilitate the dissemination of information to various stakeholder groups. The presence of a centralized platform will also streamline the MER mechanism and render any necessary improvements within the analysis, evaluation and verification of inter-island and intra-island hazards thereby potentially minimizing the disaster risks posed.

Table 14 summarizes the extent of synergies in policy coherence for Barbados on the national and international scales across different dimensions.

**Table 14: Barbados' Levels of Policy Coherence**

Coherence theme	Coherence score		
	Substantial	Partial	None
Strategic			
Conceptual			
Institutional			
Financial			
Operational			
Monitoring, Evaluation and Reporting			

# Interventions and Existing Capacities at the National Level

## Chapter 5 Overview

This chapter acknowledges the interventions made and existing capacities at the national level to support disaster risk reduction efforts in Barbados. It underscores the importance of a comprehensive understanding of disaster risk to promote risk-informed actions and decision making through data collection and dissemination, knowledge management and education, training, and awareness building via a highly participatory approach. The chapter also analyses the strengths, weaknesses, opportunities and threats posed to the current National Disaster Management Framework. It also outlines efforts to align and mainstream disaster and climate change budgetary lines into sectoral planning; implement disaster risk reduction strategies; provide incentives for disaster risk reduction activities; establish and strengthen coordination mechanisms like Early Warning Systems; and institute legislation and policies in support of disaster risk management. It is imperative that a small vulnerable economy like Barbados 'builds back better' in its recovery, rehabilitation and reconstruction efforts. This therefore poses implications on the island's current pre-disaster and post-disaster recovery processes. To date, there is an urgent need to enhance the national recovery framework, considering economic, social, environmental and infrastructural dimensions of recovery.

## 5. Disaster Risk Reduction Interventions and Capacities

Barbados' capacities and additional challenges within the disaster risk environment are discussed under the Priority Areas of the Sendai Framework for Disaster Risk Reduction in the subsequent sections.

### 5.1 Priority 1: Understanding Disaster Risk

Understanding disaster risk involves a suite of activities to promote risk-informed actions and decision making through data collection and dissemination, knowledge management (including local knowledge) and education, training, and awareness building. These activities must be conducted at all levels of society in support of the concept of shared ownership.

Barbados has made several strides at the national level to document its perceived and actualized risks and to promote greater understanding of disaster risk to the general populace. Such strides underscore the importance of a comprehensive understanding of disaster risk to promote risk-informed actions and decision making through data collection and dissemination, knowledge management and education, training, and awareness building via a highly participatory approach. Such strides have been documented within the Barbados Medium-Term Growth and Development Strategy (2013-2020) which contains goals and commitments related to disaster risk management processes under 'Section 5.5.1.4. with the objective to maintain and improve a comprehensive disaster management system'. Specific strategies to achieve this objective include: (i) An update of the National Multi-Hazard Disaster Management Plan (NMHDMP); (ii) A continuation of the Disaster Management Mainstreaming into Key Sectors Programme; and (iii) the enhancement of the legislation that governs disaster management; strengthens policy and regulatory environments; as well as strengthens the institutional capacities of the Coastal Zone Management Unit.

In 2014, the Disaster Risk Reduction: Country Document for Barbados was prepared by the United

Nations International Strategy for Disaster Reduction. This initial report provided a comprehensive overview of disaster risk for the country. However, it emphasized the need for an updated database of risk information in light of changing economic, social, environmental and physical factors. This action must be coupled with disaggregated vulnerability data collections amongst all social strata particularly amongst vulnerable groups to assess their intricate aspects of vulnerability and to facilitate greater understanding in risk-informed planning. The 2014 Country Document for Disaster Risk Reduction also advocated for incentive schemes to reduce vulnerability and exposure; warranted improvements within institutional, legal and normative frameworks; recommended improvements in capacity assessments and developmental outcomes; and encouraged greater multi-sector engagement and cooperation. The importance of early warning mechanisms and the dissemination of information as a public good were also deemed as paramount.

According to the 2018 CDM Audit, some critical strengths exist within Barbados' National Disaster Management Framework. These stem from the alignment of its Mitigation Phase of reporting with regional and international standards. For Sendai Priority 1: Understanding Disaster Risk, strengths were noted within risk identification.

### *Risk Identification*

Overall, this component was deemed as satisfactory and can be further disaggregated into (i) risk assessments and (ii) hazard assessments. Risk assessments are a common feature within the national landscape; however, hazard assessments are performing at an unsatisfactory level. The sub-elements of risk assessments include: physical, community, sectoral and environmental elements. In addition to this, only one subsidiary standard is not met partially or entirely – that the application of the CDB's National Hazard Impact Assessment methodology within the country. The sub-elements of hazard assessments include: (i) hazard knowledge, (ii) hazard mapping, (iii) hazard modelling and (iv) the availability of useful resources. In terms of the Sendai Monitor indicators, there is a paucity of information on the various subsidiary standards under the hazard assessment sub-elements:

- *The availability of useful resources*
  - o Relevant information on disasters is available and accessible at all levels

(regional, national and local), and to all stakeholders (through networks, development of information sharing systems, websites etc.)

- *Hazard Mapping*
  - o National studies related to priority hazards are completed and made public
  - o Local communities, NGOs and other stakeholders participate in the preparation, revision, publication and distribution of hazard maps.
  - o The presence of up-to-date methodologies or tools available for multi-risk assessments and cost benefit analysis
- *Hazard Modelling*
  - o The responsibility for hazard modelling has been assigned to a trained national entity (or entities)
  - o National Modelling tools are integrated/linked and are based on the most effective technology and techniques

In terms of the Sendai Monitor indicators, there is no information regarding legal requirements for Local Level Risk Assessments.

To support greater understanding of the interconnected and systemic nature of risk, national data collection, analysis and dissemination is supported by the Barbados Statistical Service (BSS)<sup>220</sup>. As a department within the Ministry of Economic Affairs and Investment, the BSS has a statutory mandate to produce and to provide reliable and timely key statistical information for evidence-based decision-making and policy development. Within this framework, data from key ministries and divisions across all sectors contribute to the National Statistical System. Under the auspices of the Ministry of Agriculture and Food Security, the Barbados Government Analytical Services facilitates the collection and analysis of water and water-related data. The Ministry of Finance, Economic Affairs and

<sup>220</sup> Barbados Statistical Service. 2022. Available at <https://stats.gov.bb/>

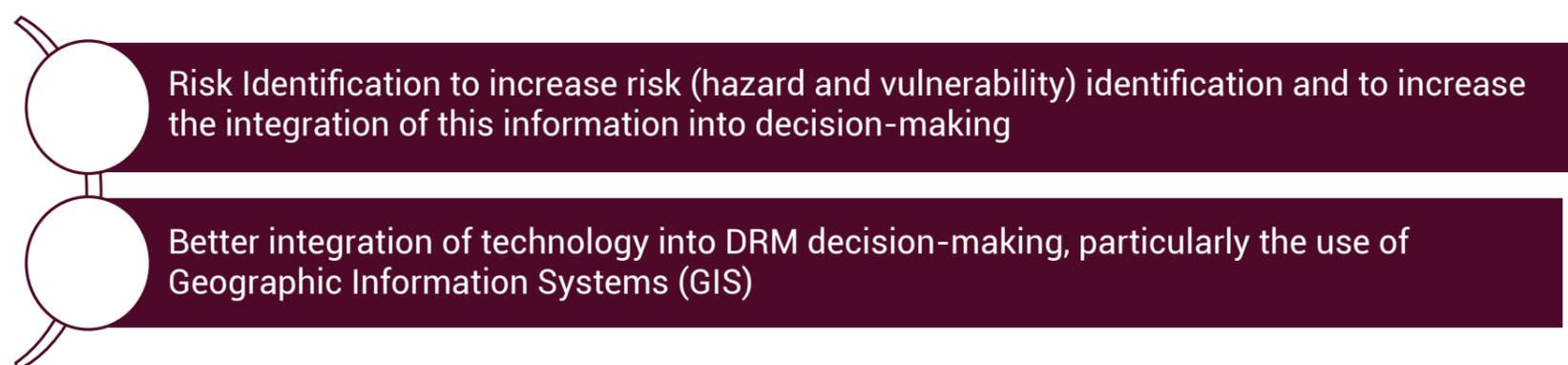
Investment as well as its associated departments<sup>221</sup> is responsible for the management of public finances. In particular, this ministry provides a wide range of information on economic and development policy issues. The Ministry of Environment and Natural Beautification promotes and facilitates the sustainable use of natural resources by encouraging the involvement of all citizens and the integration of environmental considerations into all aspects of national development. Data collection, and analysis of environmental matters is facilitated via the Environmental Protection Department (EPD) and the Coastal Zone Management Unit (CZMU). Support is also garnered from academic institutions such as the Bellairs Institute and the University of the West Indies: Cave Hill Campus – particularly within the Department of Economics; the Department for Management Studies; The Centre for Biosecurity Studies; and the Centre for Resource Management and Environmental Studies (CERMES).

To promote greater efficiency across measures (in line with International Best Standards), the GoB has conceptualized the development of appropriate Disaster Risk Management indicators given the island's vulnerability and developmental changes. The development of appropriate indicators will be used in assessments that are concurrent with outputs emanating from the Sendai Initiative. In 2017, the DEM under the auspices of the GoB submitted the Sendai Framework Data Readiness Review Report for Barbados (Preliminary report)<sup>222</sup>. The aim of the report was to showcase the extent to which the GoB disaggregates losses at the national,

local, and household levels in comparison to intra-regional and extra-regional comparators across 87 countries. In comparison to the global efforts to date, the Sendai Framework Data Readiness Review report for Barbados provided an ad hoc summary of the current situation as it related to indicator development. Concluding remarks in the aforementioned report indicated that there is currently no national database to record the disaster losses – particularly as it relates to the number of deaths associated with disaster occurrences. However, it is expected that data collection efforts for Global Target A that contribute to the wide uptake of datasets will get underway over the short to medium term. Such efforts will be conducted by the DEM. In 2017, there was no current information available at the national level regarding the remaining Global Targets devised under the Sendai Initiative.

At the time of the 2018 CDM Audit, there was no evidence of an open data platform on the national scale to support the use of Geographical Information Services (GIS). However, the Caribbean region is at the forefront of making rapid progress in the planning and development of Multi-Hazard Early Warning Systems. In addition to this, the development or usage of hazard maps is not legally mandated to be reported. Similarly, there is no standardized reporting format (for example: accessible, understandable and usable) for the island's Multi-Hazard Risk profile for various end users. Overall, the 2018 CDM Audit highlighted the following recommendations (as seen in Figure 56) in support of national mitigation efforts under this Priority Area.

**Figure 56: CDM Audit Recommendations in support of National Mitigation Efforts under Priority 1**



Source: Department of Emergency Management

221 Associated departments include the Treasury Department; Statistical Services Department; Central Purchasing Department; Special Projects – Financial; Public Investment Unit; Economic and Social Planning Development; and the Productivity Council.

222 UNDRR. 2017. "Barbados: Sendai Framework data readiness review report (Preliminary report)". <https://www.preventionweb.net/publication/barbados-sendai-framework-data-readiness-review-report-preliminary-report>

The GoB has made many strides in promoting greater research and knowledge management as envisioned under its Priority Areas for the Implementation of the Barbados Country Work Programme. Within its 2020 and 2021 Annual Reports, the DEM outlined a series of initiatives undertaken by the GoB to facilitate greater understanding of disaster risk and a better appreciation of disaster risk reduction efforts. Details regarding these initiatives can be seen in Table 15.

**Table 15: DRM Initiatives in Barbados to facilitate greater Understanding of Disaster Risk**

Priority Area	Goal	Name of the Initiative	Overall Objective
Research and Knowledge Management	The goal of this programme is to increase and sustain research, knowledge management and learning for comprehensive disaster management (CDM) <sup>223</sup> .	Human Resources Strengthening	To promote capacity building across its technical experts via several virtual training courses, seminars and workshops in various topic areas in DRM as well as Commitment for Results Planning, Logistics Planning and Management, Negotiations and Performance Development.
		Public Awareness, Information and Education	To provide information to improve public understanding and increase knowledge sharing on priority hazards at the community and household levels. This is achieved via the implementation of a Social Media and Visibility Strategy and Plan for 2020-2023 which employs the use of various types of media.
		Mainstreaming of Emergency Management in Curriculum/ Training Schedule of the Public Service and Locally based Tertiary Institutions	To conduct Liaison Officer Training intervention was held to orient and or re-orient over seventy (70) Public Officers and other stakeholders in respect of their roles within the NEMS under a CDM framework. The objective of which was to allow for a more inclusive and synchronised approach to emergency planning and response.

<sup>223</sup> This includes the development and expansion of data and information management systems; the creation, maintenance and upgrading of social media platforms; the expansion of risk knowledge for disaster risk reduction and climate change adaptation; applied disaster and risk related information for regulations and decision-making; and knowledge enhancement of the National Emergency Management System stakeholders inclusive of internal DEM staff, emergency services, private sector, public sector, community based organisations, non-governmental organisations and the general public about the various hazards will be achieved through the continued delivery of public education and public awareness programmes, focusing on multi-hazards, with special enhancement of Information Communication Technologies (ICT).

Priority Area	Goal	Name of the Initiative	Overall Objective
Research and Knowledge Management	The goal of this programme is to increase and sustain research, knowledge management and learning for comprehensive disaster management (CDM) <sup>224</sup> .	Coastal Hazards and Earthquake Smart Month	To facilitate a month of activities during March to commemorate Coastal Hazards and Earthquake Smart Month with support from the Coastal Zone Management Unit and Technical Standing Committee on Coastal Hazards. Activities included a Movie Night, a Caribe Wave Exercise, a Run Tsunami Run 5K Walk and Run, a Carpool chat and the National Earthquake Preparedness Day.
		Hurricane Awareness Month	<ul style="list-style-type: none"> <li>To further sensitize the Barbadian public, inclusive of disabled communities, to the hurricane hazard and its associated secondary hazards such as storm surge and flooding;</li> <li>To orient the population on the role of the DEM while showcasing the good practices and achievements of the department;</li> <li>To recognise and promote the work of the DEM's volunteer arm and DEOs;</li> <li>To continue to foster linkages with the private sector.</li> </ul>
		Social Media Activities and Events	To coordinate activities with a social media focus under the Public Awareness and Education Programme. Such activities sought to engage the public on was to adapt/cope in extreme events, to promote an understanding of coastal hazards and earthquakes as well as hurricane and tsunami preparedness, to sensitize the public on UN designated days/holidays via informative campaigns.

Source: The Department of Emergency Management: Annual Reports (2020-2021)

<sup>224</sup> This includes the development and expansion of data and information management systems; the creation, maintenance and upgrading of social media platforms; the expansion of risk knowledge for disaster risk reduction and climate change adaptation; applied disaster and risk related information for regulations and decision-making; and knowledge enhancement of the National Emergency Management System stakeholders inclusive of internal DEM staff, emergency services, private sector, public sector, community based organisations, non-governmental organisations and the general public about the various hazards will be achieved through the continued delivery of public education and public awareness programmes, focusing on multi-hazards, with special enhancement of Information Communication Technologies (ICT).

Despite the strides made by the GoB in promoting greater research and knowledge management as envisioned under its Priority Areas for the Implementation of the Barbados Country Work Programme, gaps still persist under Priority 1: Understanding Disaster Risk of the Sendai Framework for Disaster Risk Reduction. The GoB is therefore committed to promoting greater understanding of disaster risks to the general populace via the necessary improvements within its CDM mechanism over the short to medium terms.

To facilitate evidence-based decision-making, the knowledge repository of the CDM mechanism must be strengthened. In this regard the GoB has envisioned the establishment of an updated database platform for risk data, information and knowledge and the development of situational analyses was also deemed as a priority. However, changes in the operational context as well as conditions of vulnerability and risk are dynamic and must therefore be carefully monitored. Concerted efforts must also be made to better document the island's perceived and actualized risks whether posed by intra-island or inter-island hazards.

To support the identification of coastal risks, Barbados has begun to lay the foundation for the national Spatial Decision Support Systems (SDSS) through the National Coastal Risk Information Planning Platform (NCRIPP); however, the platform requires data inputs from all strategic partners. To date, this data input process has been slow. The NCRIPP seeks to facilitate the determination of risk exposure to hazards and is currently being used by the CZMU to assist in national development planning. Efforts are currently in place via consultancy to integrate the NCRIPP into the operations of strategic partners. There is also a resilient platform for the public procurement of resilience projects. Similarly, hazard impacts associated with previous events should be well documented to garner the most effective national response based on the adequacy of information regarding the scale of the impact as well as the extent of the vulnerability and risk posed. The fulfilment of this effort will be largely dependent upon the (i) publication of national studies; (ii) the existence of standardization of methodologies to guide risk and hazard assessments; (iii) the development of cost benefit analyses; and (iv) extensive stakeholder and community engagements to adequately identify localized hazards and disaster risks. The designation of a national authority to conduct hazard modelling

is also deemed as an imperative. This action will not only facilitate better monitoring and evaluation of hazards but also spearhead the development of early warning mechanisms.

Promoting greater knowledge sharing via the CDM mechanism is paramount. Formal and informal avenues for information sharing will create a conducive environment for continuous learning on disaster risk management. Over the short to medium term, these avenues will need to be enhanced to promote greater coherence at the technical and vocational levels. In terms of educational curriculums, CDM related concepts, disaster risk case studies and learning materials must be integrated across various academic institutions - particularly at the primary and secondary levels. Such actions, as detailed above, would not only seek to improve the knowledge base of the youth but also sensitize the general populace on disaster risk thereby facilitating greater understanding of disaster risk and a better appreciation of disaster risk reduction efforts.

Ultimately, the maintenance of the strong national Public Awareness and Education (PAE) systems is also paramount. To date, there has been an expansion of PAE systems commencing in the months of March (Coastal Hazards and Earthquake Month); April (Volcanic Hazards Awareness Week)<sup>225</sup>; and June (Hurricane Awareness Month). Public awareness and sensitization campaigns should be conducted throughout the year and not just within the designated periods of historical hazard impacts. The PAE systems should employ a highly participatory approach to engage a diverse groups of stakeholders – particularly disadvantaged groups to broaden the knowledge base of the populace on a wide range of hazards and disaster impacts. Through the National Emergency Management System, the capacity to implement the PAE systems will be strengthened. This will promote knowledge sharing and technological transfer across the NEMS and enhance opportunities for NEMS members to become more exposed to current DRM knowledge and transformational thinking.

Vulnerable groups such as women, indigenous communities, migrants, persons with disabilities, and youth, experience disasters differently but also possess their own capacities. Integrating these groups, their experiences and knowledge can be

<sup>225</sup> This Awareness Week is held annually during the second week of April.

meaningful in developing effective strategies and actions. The Emergency Management Advisory Council (EMAC) (with its distinct roles as specified by its Standing Committees<sup>226</sup>) includes standing membership from NGOs and CSOs. Concerted efforts must therefore be taken to ensure the inclusion of such special interest groups in future knowledge processes.

## 5.2 Priority 2: Strengthening Disaster Risk Governance to Manage Disaster Risk

Disaster risk governance involves mainstreaming disaster risk reduction within and across all sectors; implementing disaster risk reduction strategies; providing incentives for disaster risk reduction activities (such as compliance with building codes); establishing and strengthening coordination mechanisms; and instituting legislation and policies in support of disaster risk management.

According to the 2018 CDM Audit, some critical strengths exist within Barbados' National Disaster Management Framework. These stem from the alignment of its Mitigation Phase of reporting with regional and international standards. For Sendai Priority 2: Strengthening Disaster Risk Governance to Manage Disaster Risk, strengths were noted within structural mitigation (e.g., new and old facilities). However, the country's performance on the non-structural mitigation component was deemed as unsatisfactory.

### *Structural Mitigation*

Overall, this component was deemed as satisfactory and regarded as the strongest index within the mitigation phase. It can be further disaggregated into (i) new facilities and (ii) old facilities. Under new facilities, sub-elements such as the planning process and maintenance aspects were deemed as satisfactory. This suggested that there is an effective planning process regarding protocols like building permits that were established for critical infrastructure<sup>227</sup> and land use planning policies. Similarly, the existence of a dedicated maintenance

budget for critical infrastructure facilitates a maintenance schedule for educational facilities – institutions which primarily act as emergency shelters during inclement weather. Under old facilities, the two sub-elements of retrofitting and maintenance were deemed as satisfactory. The former seeks to improve the resilience of old critical infrastructure and may require external financing to improve the structural and non-structural vulnerability of physical assets. Maintenance under this component generally relates to educational facilities as religious buildings – for example churches are maintained via their respective budgets. In terms of the Sendai Monitor indicators, there is no information regarding new and or old facilities.

### *Non-Structural Mitigation*

This component consists of four elements: (i) Land Use Planning, (ii) Safety Standards, (iii) Building Codes, and (iv) Incentives – the latter two of which represent major areas of special attention as the level of performance of these measures was deemed as unsatisfactory. For instance, in terms of the Sendai Monitor indicators, there is no information regarding National Building Codes.

In support of the development of the land use policies, some exceptional strengths were observed within land use planning on the national scale during the 2018 CDM Audit. Land use planning is comprised of three elements: (i) national standards; (ii) application and enforcement; and (iii) zoning. All of these sub-elements achieved satisfactory scores on their subsidiary standards. Effective land use planning is maintained via the Barbados Physical Development Plan (PDP) which acts as the overarching legislative framework regarding land usage within this densely populated society. Under Application and Enforcement, there is one index that is not applicable to the Barbadian context – the consideration of indigenous populations. National zoning regulations are in full effect on the island and have delineated regions for water zoning and airport zoning as well as unstable subregions like the Scotland District that is highly prone to land slippage.

In support of the development of safety standards, only one area of scope was deemed as above par for non-structural mitigation during the 2018 CDM Audit. Such standards consist of one element: National Safety Standards which is represented by two subsidiary standards. In Barbados, there are clearly defined roles, responsibilities and mechanisms for the development, monitoring, and

226 The Standing Committees of the Emergency Management Advisory Council (EMAC) are generally organized along the Emergency Support or Response Functions or sector response: Emergency Services; Public Information & Education; Damage Assessment and Needs Analysis; Health Services – Medical & Public Health; Food & General Supplies; Public Utilities; Emergency Transport; Shelter Management; Disaster Social Relief; Road Clearance & Tree Trimming; Telecommunications; Housing and Rehabilitation; National Hazard Mitigation; Tourism Emergency Management; Technical Standing Committee on Coastal Hazards; and Oil Spill Committee.

227 This is related to educational facilities on the island.

enforcement of safety standards. However, the full implementation of the Pan American Health Organisation (PAHO) SMART hospital program is required in order to increase the score of this sub-element and key element. This program has not been fully implemented; however, various aspects of it have been executed within hospitals and health centres across the island.

There is a grave need to address the lack of legislation and hence enforcement regarding the national building codes. This non-structural mitigation measure is based upon the Regional Building Standards (RBS) which have been modelled from international codes utilized in Europe and North America. Another hinderance is the lack of a formal legislative authority for the department tasked with developing and implementing building codes - the Building Standards Authority (BSA). Therefore, while there are clearly defined roles and responsibilities for monitoring and enforcement of building codes written into the BSA codes, the BSA cannot monitor, inspect, or enforce any of the unlegislated standards. However, other institutions can and do monitor and enforce aspects of the building code that are aligned with their mandate. Such entities include the Town and Country Planning Department that inspects buildings for alignment to code on the issue of fire safety. In addition, authorities must employ clearly defined roles and responsibilities for the monitoring and enforcement of building codes. Moreover, there are no technical inspections or resources to monitor and enforce the application of building codes which must be seriously addressed.

According to the 2018 CDM Audit, the Preparedness Phases of reporting encompassed six (6) themes: (i) Governance, (ii) Education and Information, (iii) Training and Exercises, (iv) Warning and Alerts, (v) Finance and Administration, and (vi) Community Resilience. In particular, Governance attained a satisfactory score overall and encompassed four (4) sub-elements: (i) Legislative Frameworks, (ii) Policy Frameworks, (iii) Strategic Frameworks and (iv) Planning Frameworks.

Legislative frameworks generally represented an area of strength in terms of national legislations mandating CDM responsibilities. Barbados has spearheaded efforts to cope and prepare for future hazards. This is noted in the formulation of national and sectoral frameworks<sup>228</sup> to address the incidence of natural hazards and to reduce the root causes

of vulnerabilities. As seen in Table 16, overarching policy frameworks guiding CCA and DRM include:

- The National Strategic Plan
- The Barbados Comprehensive Disaster Management (CDM) Policy (2022)
- The Medium-Term Growth and Development Strategy
- The Physical Development Plan
- The Barbados Roofs to Reefs Programme
- The Draft National Climate Change Policy Framework
- The Updated Barbados Integrated Coastal Zone Management Plan (2020-2030)
- The Disaster Social Relief Plan
- The 2008 Throne Speech
- The Barbados Sustainable Development Policy
- The Barbados' Groundwater Protection Zoning Policy

<sup>228</sup> Similarly, many national initiatives exist to strengthen policy frameworks within the agricultural, transportation, tourism, health and housing/infrastructure sectors.

**Table 16: Summary of Overarching Legislative Frameworks guiding CCA and DRM at the national level**

Policy Name	Aim	Objectives	Coordinating Bodies
<b>The National Strategic Plan (NSP) of Barbados 2006-2025<sup>229</sup>: 'Global Excellence, Barbadian traditions'</b>	This policy framework represents the overarching goal for the future sustainability of the Barbadian economy through the articulation of a clear vision "to become a fully developed society that is prosperous, socially just and globally competitive by the end of the first quarter of this century".	Underlying objectives of Goal 4 include: <ul style="list-style-type: none"> <li>• To promote and facilitate the environmentally sustainable use of our natural resources;</li> <li>• To maintain a safe and reliable water supply;</li> <li>• To ensure an efficient and reliable energy sector;</li> <li>• To develop a modern transport infrastructure;</li> <li>• To improve disaster management; and</li> <li>• To maintain an efficient land-use policy.</li> </ul>	<ul style="list-style-type: none"> <li>• All Government Ministries/ Authorities</li> </ul>
<b>The Barbados Comprehensive Disaster Management (CDM) Policy (2022)</b>	To provide the supportive governance and accountability arrangements to guide the development and mainstreaming of CDM policies and programs at the national level via a highly participatory approach to facilitate reduced losses and damages and to promote safer communities, more resilient people, a protected environment, a stable society, and sustainable economy.	<ul style="list-style-type: none"> <li>• Provide the strategic direction and supportive governance and accountability arrangements for a safer, more resilient and sustainable Barbados through CDM</li> <li>• Guide the development and mainstreaming of CDM policies and programs for a resilient Barbados society;</li> <li>• Ensure Barbados meets its regional/international disaster management obligations; and</li> <li>• Articulate the vision and goals for comprehensive disaster management for the Government of Barbados in line with the objectives of the Emergency Management Act, Cap. 160A (2007)</li> </ul>	<ul style="list-style-type: none"> <li>• All Government Ministries/ Authorities</li> </ul>

<sup>229</sup> Encompasses six goals and is based on the development and integration of sectoral strategic plans. Goal 4 of the National Plan advocates the building of a Green Economy via the 'Strengthening the Physical Infrastructure and Preserving the Environment'.

Policy Name	Aim	Objectives	Coordinating Bodies
<b>The Medium-Term Growth and Development Strategy 2013-2020</b> <sup>230</sup>	This policy framework proposes a long-term vision for the island to become a “fully developed and people-centred society, through new development pathway”.	<p>The objectives of the policy focus on improving the operational efficiency and efficacy of some governmental departments. objectives of this aspect of the policy include:</p> <ul style="list-style-type: none"> <li>• 5.5.1.1 To ensure an efficient and reliable energy sector;</li> <li>• 5.5.1.2 To ensure the orderly and progressive development of land in both urban</li> <li>• 5.5.1.3 To provide adequate shelter for all, that is; improving and maintaining acceptable living conditions on a sustainable basis;</li> <li>• 5.5.1.4 To improve disaster management</li> <li>• 5.5.2.4 To reduce the solid waste levels and generate energy</li> <li>• 5.5.2.5 To maintain a safe and reliable water supply in rural areas;</li> </ul>	<ul style="list-style-type: none"> <li>• All Government Ministries/ Authorities</li> </ul>
<b>The Physical Development Plan</b>	This policy framework, originally drafted in 1998 and amended in 2003, addresses land usage within the densely populated society of Barbados	<ul style="list-style-type: none"> <li>• Foster the economic, environmental, physical and social well-being of the residents of Barbados;</li> <li>• Address the critical impacts of climate change on Barbados as a Small Island Developing State (SIDS) through policies and strategies that enable the people of Barbados to thrive and remain resilient under changing climatic conditions; and</li> <li>• Establish a vision to guide the future form of development with respect to land use, settlement patterns, food production, infrastructure and environmental management;</li> </ul>	<ul style="list-style-type: none"> <li>• The Town and Country Development Planning Office</li> </ul>

<sup>230</sup> As it relates to this study, special attention was paid to the Infrastructural development and modernization section within this policy document\*

Policy Name	Aim	Objectives	Coordinating Bodies
<b>The Barbados Roofs to Reefs Programme</b>	This policy framework seeks to integrate mitigation and adaptation climate concerns with a social policy geared towards improving the standard of living and quality of life for all - particularly the most vulnerable segments of the population of Barbados. The programme also supports improved infrastructure resilience to natural hazards.	<ul style="list-style-type: none"> <li>• Make low- and middle-income homes more resilient to extreme events</li> <li>• Increase freshwater storage capacity and water use efficiency</li> <li>• Reduce carbon emissions through distributed renewable energy generation and energy efficiency</li> <li>• Reduce carbon emissions and treating waste as a resource (circular economy)</li> <li>• Implement more sustainable land (and marine space) use practices</li> <li>• Restore reduced ecosystem services</li> </ul>	<ul style="list-style-type: none"> <li>• The Ministry of Environment and Natural Beautification</li> </ul>
<b>The Draft National Climate Change Policy Framework</b>	This policy framework highlights Barbados' commitment to address climate change adaptation and mitigation at the national level whilst adhering to regional and international frameworks	<ul style="list-style-type: none"> <li>• Establish an appropriate mechanism for responding to challenges related to climate change;</li> <li>• Engage in regional and international climate change negotiations, planning and response mechanisms;</li> <li>• Effect full stakeholder engagement in the development and execution of domestic climate change mitigation and adaptation actions; and</li> <li>• Conduct climate change research.</li> </ul>	<ul style="list-style-type: none"> <li>• The National Climate Change Committee<sup>231</sup></li> </ul>
<b>The Updated Barbados Integrated Coastal Zone Management Plan (2020-2030)</b>	This policy framework seeks to provide detailed guidance on the management of coastal resources.	To develop and implement an integrated National Coastal Zone Management Plan, and to continue working to ensure that the coast retains its vital and pivotal role in the social and physical development of Barbados.	<ul style="list-style-type: none"> <li>• The Coastal Zone Management Unit</li> </ul>

231 This committee includes representatives from the Ministry of Environment and Natural Beautification: Policy, Planning and Research Unit (Chair); Coastal Zone Management Unit; Environmental Protection Department; Natural Heritage Department; Drainage Division; Ministry of Agriculture, Food, Fisheries and Water Resource Management: Agricultural Planning Unit; Barbados Meteorological Services Department; Barbados Water Authority; Ministry of Finance and Economic Affairs: Division of Economic Affairs; Public Investment Unit; Ministry of Health: Environmental Health Department; Ministry of Home Affairs: Department of Emergency Management; Ministry of Social Care, Constituency Empowerment and Community Development: Social Care Division; Bureau of Gender Affairs; Ministry of Transport and Works; Ministry of Tourism and International Transport; Office of the Prime Minister: Division of Energy and Telecommunications (Energy Division); Representative from a Youth Group: Caribbean Youth Environment Network -Barbados Chapter; Representative from a Community Based / Non-Governmental Organisation: Global Environment Facility Small Grants Programme – Barbados; The University West Indies (UWI Cave Hill): Centre for Resource Management and Environmental Studies; Representatives from Business Sector: Insurance Corporation of Barbados; The Barbados Light and Power.

Policy Name	Aim	Objectives	Coordinating Bodies
<b>The Disaster Social Relief Plan</b>	This policy framework seeks to make provisions for Disaster Social Relief to people who require food, clothing or compensation in the aftermath of an emergency. The services described in this plan (Disaster Social Relief; Food and General Supplies; and Housing Repair and Replacement) may be needed in the aftermath of incidents of limited scale as well as major emergencies or disasters.	<ul style="list-style-type: none"> <li>To develop a plan that would guide the response to Disaster Social Relief;</li> <li>To institute systematic guidelines for responders in delivering effective social services, including food and supplies;</li> <li>To provide a coordinated, efficient and effective system of Disaster Social Relief to victims; and</li> <li>To ensure the expeditious delivery of goods and services to priority areas based on needs analyses and damage assessment reports.</li> </ul>	<ul style="list-style-type: none"> <li>The Ministry of People Empowerment and Elder Affairs</li> <li>Ministry of Education, Technological and Vocational Training (METVT)</li> <li>The Ministry of Agriculture and Food Security (MAFS)</li> <li>The Ministry of Home Affairs (MHA)</li> <li>The Ministry of Housing, Lands, and Rural Development (MHLR)</li> <li>The Urban Development Commission (UDC)</li> </ul>
<b>The 2008 Throne Speech</b>	This statement reaffirmed the Government of Barbados' commitment to propel the Barbadian economy forward in the global economic crisis whilst attempting to promote cultural retention and aspire to a higher level of development (that is people oriented, culturally specific and socially rooted on the basic spirituality of our ancestors).	<p>Highlighted the following issues that can plague the advancement of the Barbadian economy:</p> <ul style="list-style-type: none"> <li>The cost of living;</li> <li>Health care;</li> <li>Education;</li> <li>Social Security;</li> <li>Transportation/ Infrastructural Development</li> <li>Land use planning (as it relates to environmental protection and agricultural development)</li> </ul>	<ul style="list-style-type: none"> <li>All Government Ministries/ Authorities</li> </ul>
<b>The Barbados Groundwater Protection Zoning Policy</b>	This policy framework regulates the protection of water sources from environmental pollutants with 'decreasing stringencies from Zone 1 to Zone 5'	<ul style="list-style-type: none"> <li>To address issues surrounding water quality, distribution, cost and availability of the resource to the general populace</li> </ul>	<ul style="list-style-type: none"> <li>Agencies: The Barbados Water Authority (BWA), Ministry of Health and the Town and Country Development Planning Office</li> <li>Actors: BWA &amp; the Environmental Protection Department</li> </ul>

Details regarding the legislative practices across various sectors and institutions that are involved in DRR<sup>232</sup> can be seen below.

### **Agricultural Sector**

Many national initiatives exist to strengthen the policy framework for sustainable agriculture in Barbados. As seen in Table 29 of Appendix X, such initiatives include the following rebates, grants, technical assistance, and discounts: (i) Fiscal incentives to spur production; (ii) Resource protection and management; (iii) Organic farming and (iv) New crop production.

### **Housing Sector/Buildings**

The Barbadian landscape has undergone significant demographic changes from a plantation economy to a more upscale urban society – with most urban settlements being concentrated along the coastal corridor. As the society enjoys a high standard of living noted by its historically high Human Development Index, there is an ever-increasing demand for housing. To address this, the GoB under the auspices of the Ministry of Housing and Lands has devised the varied housing strategies and programmes (as seen in Table 30 of Appendix X). These efforts seek "to provide adequate shelter for all and to create home ownership for the majority of the population by providing the opportunity for the widest majority of Barbadians to own property".

The construction of commercial and residential buildings has the potential to pose detrimental impacts on natural and human resources through the unsustainable use of land and energy, the removal of natural materials, transport of construction materials, liquid and solid waste generation, poor utilization and recycling of building materials and the use of hazardous building materials. Similarly, noting the increasing prevalence of sick buildings within the built environment, the adoption of a green approach to building aims to reduce the impact on human health and the environment during the building's life cycle.

Through the green approach, a sustainable housing/building industry is recognized as having the potential to make a positive contribution to the environmental, social and economic sustainability of the Barbadian community. Moreover, the greening of the housing/building industry is consistent with the commitment of the current Government Administration to track progress in greening the economy towards

achieving sustainable development. Green buildings are commonly assessed on the following measures:

- Sustainable site development: selecting locations for buildings that minimize impacts on ecosystems and undeveloped land, maximizing use of native landscape and regional transit connections;
- Water efficiency: using more efficient water fixtures inside along with landscaping along with water efficient irrigation outside;
- Energy efficient: incorporating a combination of technologies and design to minimize use of energy;
- Materials selected: using sustainably grown and produced building materials and reusing and recycling existing materials through deconstruction (where appropriate); and
- Indoor environmental quality: using non-toxic building material, Heating, Ventilation, and Air Conditioning (HVAC) systems, and natural daylight to produce clean healthy air.

Noting the island's high susceptibility to hydrometeorological hazards and other intra-island and inter-island hazards, the GoB has also provided incentives to property owners who retrofit their buildings to enhance resilience. The current government thought its housing encourages hurricane-resilient design (especially roof design) via concessional financing. In late 2021, following the passage of Hurricane Elsa, the GoB has also explored viable alternative housing solutions. This includes the utilization of steel houses in efforts to circumvent issues arising from housing reallocations during extreme weather impacts. Such an initiative thereby seeks to minimize the disaster risk posed by major displacement.

In Barbados, there are several national policy initiatives in support of comprehensive waste management and energy efficiency that support green building. However, there is no specific integrated, national, green building policy, programme or strategy for the housing/building industry. The regulation of building and design standards is currently shared by several agencies. Table 31 of Appendix X provides an overview of the regulatory agencies with shared

232 This was previously discussed in Section 3.3. and Section 3.4.

responsibility for policy implementation within the housing/building industry.

### Transportation Sector

From a DRM perspective, the Ministry of Transport and Works (via the Barbados Transport Board) acts as a primary coordinating body for the National Emergency Response during the onset of extreme weather events. Table 32 of Appendix X provides a summary of the roles and responsibilities of key regulatory agencies in the Transportation sector.

### Tourism Sector

The island's tourism sector is governed by the Barbados Tourism Master Plan (2014-2023) as previously mentioned in Section 3.3.2. The Tourism Master Plan requires a highly participatory approach in order to adequately address a series of priority actions within the following twelve (12) strategic imperatives (as seen in Tables 21-23 of Appendix XIII). Priority actions differ in timescales (whether over the short, medium or long term) and the degree of intervention required. Priority actions are therefore classified as urgent, enabling or sustaining actions<sup>233</sup> (Government of Barbados, 2014).

### Health Sector

The Barbadian health sector is currently grappling with a series of challenges that have been exacerbated since the onset COVID-19 pandemic. As a result, a number of these health care systems will need to be repurposed to promote transformational thinking. To aid in the strengthening of governance for disaster risk, Table 33 of Appendix X provides information on the types of indicators that can be used to promote efficiency and effectiveness within the health sector. These include but are not limited to:

- The PAHO's Hospital Safety Index
- Maternal and reproductive health
- Neonatal health
- Hospitalizations due to simple extremes:
  - o Vector-borne diseases; Food-borne diseases; Water-borne diseases and Thermal extremes
- Hospitalizations due to complex extremes:
  - o Floods, Tropical storms, Tropical cyclones, Droughts

- Hospitalizations due to Communicable Diseases
- Hospitalizations due to Non-Communicable Diseases

However, issues regarding climate change and adaptation represent an area of weakness within Legislative Frameworks. For instance, there is a general paucity of national policy instruments that directly address to climate change. Other than the Draft National Climate Change Policy Framework, most policy instruments collectively address sustainable development, CCA and DRR to varying degrees. Similarly, there is a lack of sectoral legislation that reflects CDM, climate change resilience and resilient development.

At the national level, there have been various initiatives to promote the importance of climate change to a Small Island Developing State like Barbados via the pursuit of the Green and Blue Economies. In light of such efforts, institutional arrangements need to be strengthening to minimize the instances of duplication across ministries and departments as well as the existence of extensive bureaucratic red tape. The continuation of climate resilient efforts on the island will seek to ensure that an all-encompassing all-of-society approach is adhered to facilitate full stakeholder buy-in at the national and sub-national levels.

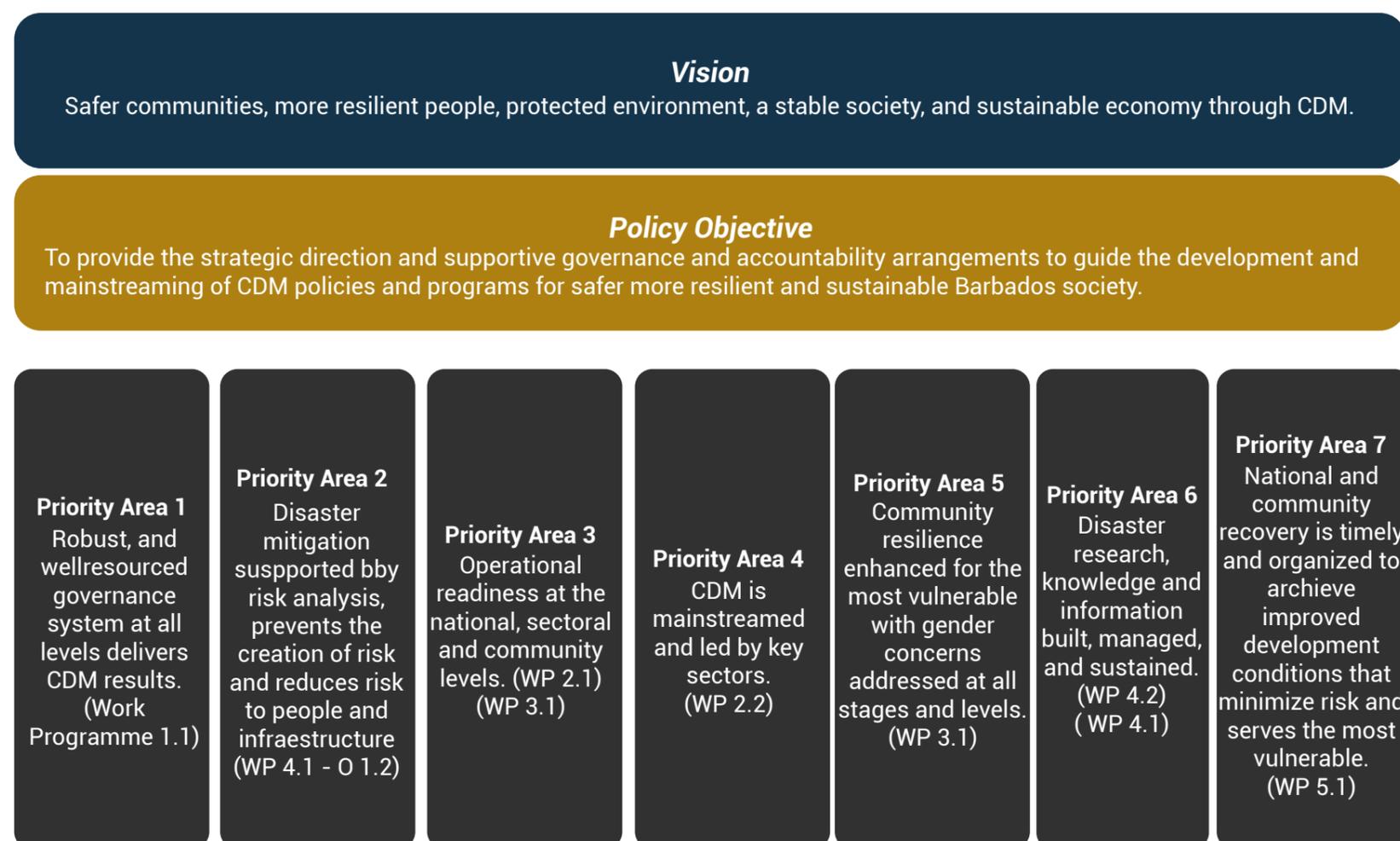
Policy Frameworks were generally deemed as satisfactory; however, there was a paucity of disaster legislation to support a national CDM policy during the 2018 CDM Audit. Notwithstanding the existence of the Barbados Country Work Programme, the Disaster Social Relief Plan and the Emergency Management Act (2007), it was noted that the latter legislation requires revision. In September 2022, the GoB adopted the Barbados CDM Policy (2022). This action represents the government's high degree of political will and transformational thinking to ensure citizen security. The policy outlines the national strategic mission to keep individuals safe and to make communities more resilient to disaster and climate-related risks and impacts.

The policy statement for the Barbados CDM Policy is comprised of three (3) major components. These include: (i) a Vision; (ii) Policy Objective and (iii) Priority Areas of Action (as depicted in Figure 57). For the latter, seven (7) Priority Areas of Action are outlined to address the challenges emerging from the review of the issues, gaps and challenges to deliver CDM mandate. These Priority Areas of Action focus on governance; disaster mitigation;

<sup>233</sup> Urgent Actions represent those actions that are required immediately to respond to the current economic situation and to increase visitor arrivals and visitor spend within the BVE. Enabling Actions represent actions that are required to support the effective and efficient functioning of the BVE; without these actions, the BVE would continue to operate at sub-optimum levels. Sustaining Actions represent the actions that are required to maintain the BVE and to ensure its sustainability and resilience into the future.

operational readiness; sector mainstreaming; resilience building in sectors, ensuring communities are central to the disaster management strategy; building the knowledge base and organising for recovery. These priority areas are being delivered through the CDM approach that addresses all people, hazards and phases of DRM. It is also being delivered in a context that facilitates the CDM Enabling environment which consists of the ICT platforms for knowledge sharing, information management, and large-scale transformation.

**Figure 57: The Policy Statement of the Barbados CDM Policy (2022)**



Source: The Barbados Comprehensive Disaster Management Policy, 2022

Adequate governance arrangements and capacity for key players also support the enabling framework for communities, government, and the private sector to reduce risk and to deliver the CDM Strategy. A mainstreaming framework is the main approach for delivery whereby CDM is integrated in all national development plans and instruments. These include Poverty reduction strategies, the National Sustainable Development Plans, the Physical Development Plan, Medium Term Economic Strategy Papers (MTESPs), and Public Sector Investment Portfolios (PSIPs). These are all integrated into all aspects of development at all levels of everyday activity by the entire society. Each priority area provides the basis for implementation through the Barbados Country Work Programme (CWP) which is a short-term policy document that operationalises the CDM Policy. The CWP is aligned with the Regional CDM Strategy as well as the national level CDM Strategy and Framework. As seen in Appendix IV, the current Barbados CWP encompasses the period 2019-2023.

The National CDM Policy seeks to:

- Provide the strategic direction and supportive governance and accountability arrangements for a safer, more resilient and sustainable Barbados through comprehensive disaster management;
- Guide the development and mainstreaming of CDM policies and programs for a resilient Barbados society;

- Ensure Barbados meets its regional and international disaster management obligations; and
- Articulate the vision and goals for comprehensive disaster management for the GoB in line with the objectives of the Emergency Management Act, Cap. 160A (2007).

In addition to this, the National CDM Policy is enshrined with the following values (as seen in Figure 58) and guiding principles (as seen in Appendix X).

**Figure 58: The Values enshrined within the Barbados CDM Policy (2022)**



Source: The Barbados Comprehensive Disaster Management Policy, 2022

As a Policy Framework, the CWP provides a comprehensive vision for the management of intra-island and inter-island hazards via a highly participatory approach that involves all-of-society – particularly various actors within the National Emergency Management System (NEMS). Even though the CWP represents a holistic policy, concerted efforts must be made to promote sector-driven initiatives that delve further into the complex intricacies of national sectors. The Sendai Framework for Disaster Risk Reduction 2015-2030 emphasizes the need to establish public-private partnerships for disaster risk reduction to better address the socio-economic impacts of disasters. Within Barbados, the private sector is well poised to support disaster risk reduction efforts on the island as it has previously done with other facets of national development via the establishment of the Barbados Social Partnership initiative. Through this initiative, the private sector can therefore support disaster risk reduction<sup>234</sup> by developing contingency plans, ensuring business continuity and improving disaster preparedness via new and improved public-private sector partnerships<sup>235</sup>. Similarly, through the Global Private Sector's Alliance for Disaster Resilient Societies (ARISE) initiative<sup>236</sup>, inter-regional stakeholder engagements can be strengthened to promote greater knowledge exchanges; facilitate proactive actions across the private sector to prevent economic losses and to promote new business opportunities related to disaster risk reduction efforts.

234 BGIS. 2022. "Disaster Management Partnerships 'Arise' ". <https://gisbarbados.gov.bb/blog/disaster-management-partnerships-arise/>

235 BGIS. 2022. "Private Sector Partnerships Key To Boosting Production". <https://gisbarbados.gov.bb/blog/private-sector-partnerships-key-to-boosting-production/>

236 UNDRR. 2022. "ARISE Initiative". <https://www.ariseglobalnetwork.org/>

Strategic Frameworks which include the National CDM Strategy and M&E Systems are aligned to sectoral, regional and international CDM strategies. Sectoral plans include the Tourism Master Plan as well as plans for healthcare, housing, education and agriculture. The Barbados CDM Policy (2022) also includes a Monitoring, Evaluation and Verification Mechanism which seeks to ensure the full implementation of the national CDM Policy. To guide future planning and development processes, the mechanism will measure and monitor changes within the CDM policy framework in an effort to track its overall efficiency and effectiveness.

The purpose of the MER framework is to provide credible information on the analysis of newly devised CDM policy intervention. This information will seek to inform decision makers by: (i) verifying whether the desired targets have been achieved; (ii) underscoring the degree to which circumstances may have changed; and (iii) determining the extent to which policies are on track and possibly approaching their implementation phases. Information garnered from the pilot MER mechanism will be used to establish MER mechanisms and frameworks

with increased transparency over the medium to long terms. It is anticipated that the development of such initiatives would adopt a standardized methodology. This would ensure greater data integrity within the operational and policy space as well as facilitate greater accountability and responsibility within designated roles. It would also create a conducive environment for continuous learning, scheduled reporting timelines and DRM phase evaluations. The development of more transparent MER mechanisms and frameworks will also facilitate the dissemination of information that is devoid of complex technical jargon to various stakeholder groups and end users. The overarching responsibility for the MER mechanism will reside with a designated Working Group of the Emergency Management Advisory Council (EMAC) therefore any changes to the existing CDM Policy will be approved by the designated Working Group. The MER mechanism will be monitored by the CDM National Disaster Offices (NDOs) in collaboration with National M&E units and Central Statistical Offices. Figure 59 highlights the strategic objectives under the MER mechanism to support the implementation of the Barbados CDM Policy (2022).

**Figure 59: Strategic Objectives under the MER mechanism to support the implementation of the Barbados Comprehensive Disaster Management (CDM) Policy (2022)**



Source: Government of Barbados, 2022

Disaster Risk Management in Barbados is coordinated by the Department of Emergency Management (DEM) which falls under the auspices of the Ministry of Home Affairs and Information. Established in 2007, under the statutory legislation entitled 'The 2006 Emergency Management Act, Cap. 160A', the DEM is preceded by the Central Emergency Relief Organisation<sup>237</sup> (CERO) Secretariat (established in 1978) and also the Organization for Hurricane Relief<sup>238</sup> (established in the 1940s) – the latter two of which represent organizations solely responsible for disaster relief activities on the island during the colonial and post-colonial eras. Through its Emergency Management Act Cap. 160A, legislation empowers the Governor General to declare a state of public emergency by proclamation and mandates that the Governor General communicates this grave situation to the Parliament and summons both Houses. Once a declaration is in force, the Cabinet of Barbados is authorized to make emergency directives to provide for the supply of specified essentials such as food, basic public utilities; maintaining transportation; taking possession or control of property other than land; and paying compensation. In addition to this, the Emergency Management Act Cap. 160A Act permits the DEM to conduct inter alia, country-wide emergency management planning and administrative mechanisms, Environmental Impact Assessments, special area planning, and the delineation of vulnerable areas.

At the National level, there is a Comprehensive National Emergency Management System (NEMS) which acts as the overarching mechanism to facilitate coordination across various ministerial portfolios and departments under the auspices of the GoB. Coordinated by the DEM, this holistic multisector, multi-stakeholder mechanism (as seen in Figure 60) is comprised various stakeholder groups:

- The Emergency Management Advisory Council (EMAC) and its Standing Committees;
- National Emergency Services;
- Local Volunteers;
- Non-Governmental Organisations (NGOs);

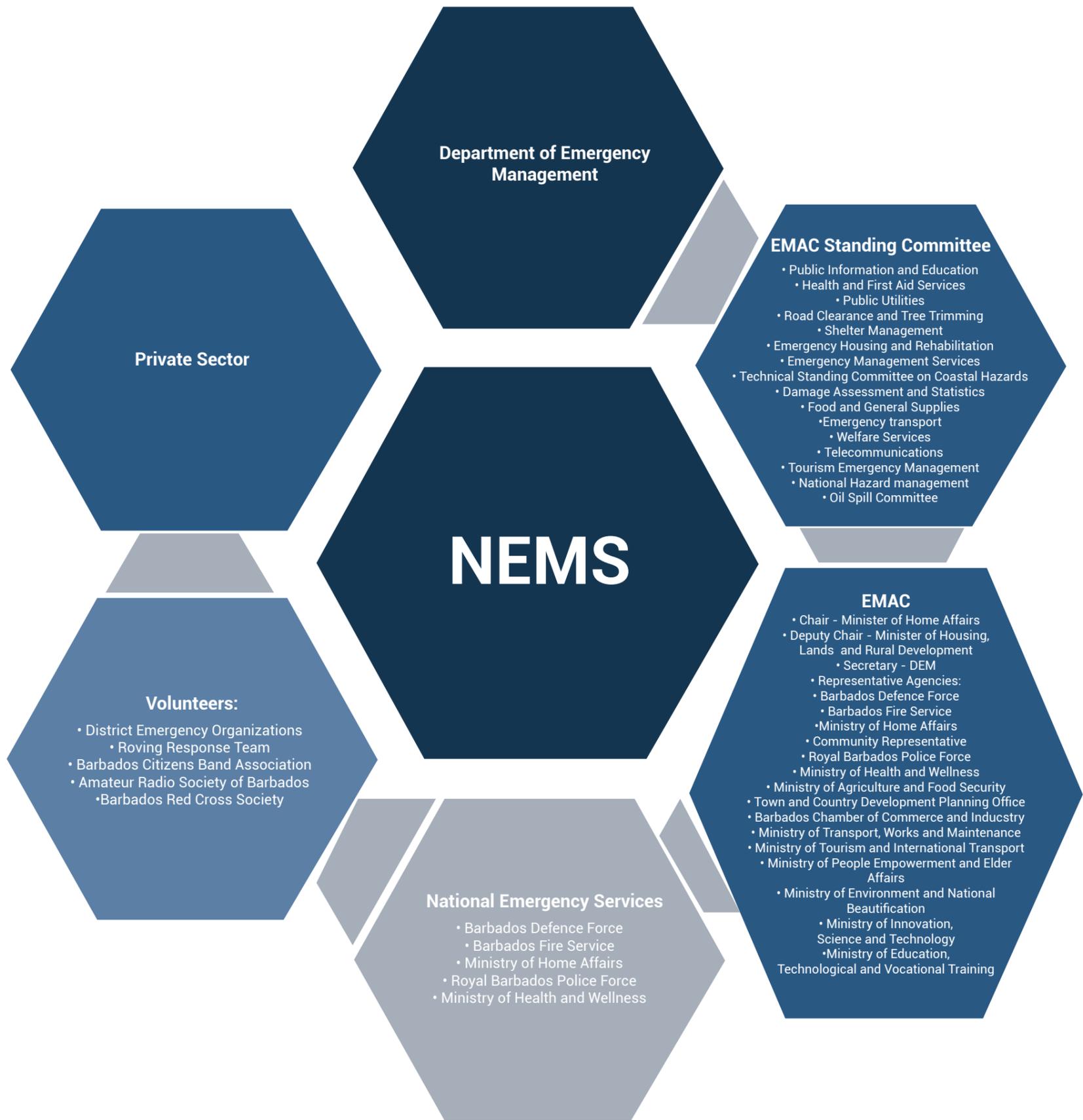
- Community-Based Organisations (CBOs),
- Regional and International Partners; and
- The Private Sector.

These entities cumulate human resources, technical expertise and other resources to facilitate an 'Effective State of Readiness' and to address disaster risk reduction within Barbados. The EMAC, which is chaired by the Minister responsible for Disaster Risk Management, was established by the Emergency Management Act Cap 160 (2007). The committee is comprised of both public and private sector agencies as well as non-governmental entities. The functions of the EMAC include: (i) providing recommendations on policies, programmes and activities to enhance the emergency management programme; and (ii) reviewing the work of its Standing Committees with respect to their specialized areas and function. There are currently sixteen (16) Standing Committees that fall under the auspices of the EMAC. They are responsible for the planning aspects of the Emergency Response Functions (ERFs) at the national and local levels under the purview of their respective thematic areas. The membership base of the Standing Committees is organized by ERFs and designated by thematic area – for instance shelter management, emergency telecommunications, public utilities, damage assessment and needs analysis amongst others. The Standing Committees are chaired by technical leads of several government agencies with responsibility for the execution of national disaster management policy and programmes in their respective areas of expertise. This disaggregation of tasks across the EMAC Standing Committees supports the Guiding Principle of shared responsibility between central governments and local authorities, sectors and stakeholders.

237 The Central Emergency Relief Secretariat which provided administrative support and coordination to the wider disaster management system in Barbados.

238 In contrast to the Department of Emergency Management, this Organization was never fully aware of the need for a plan for disaster preparedness, although the public was informed of an impending hurricane in the form of public warning which were arranged according to the standard hurricane categories of Advisory, Cautionary Warning and the onset of a hurricane.

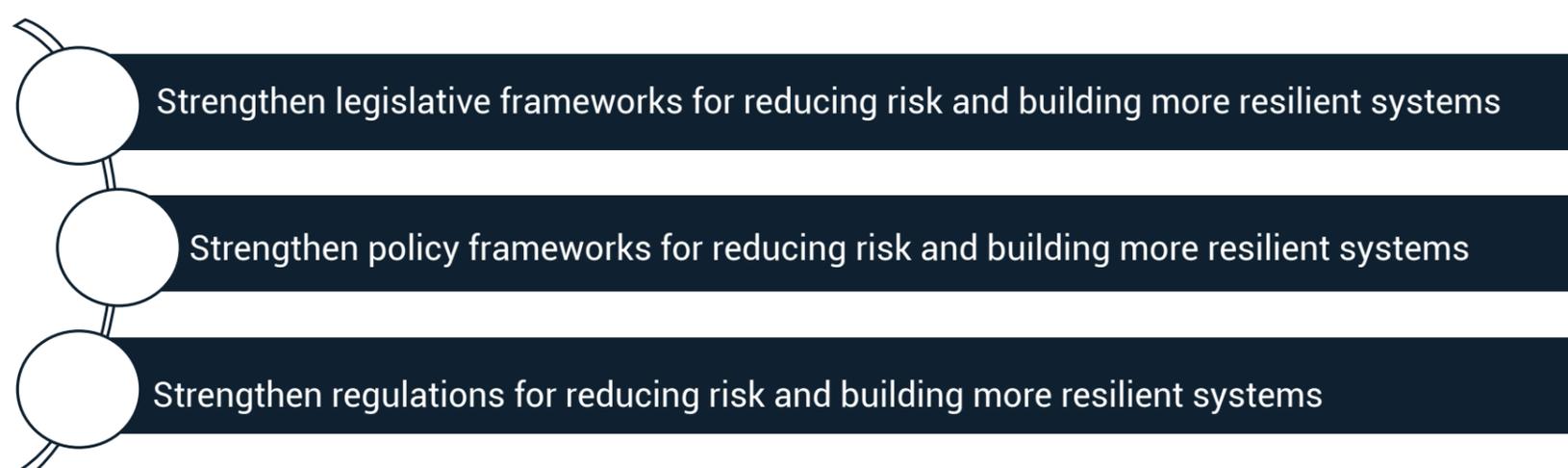
Figure 60: The Components of the National Emergency Management System



Source: The Barbados Comprehensive Disaster Management (CDM) Country Work Programme (CWP) (2019 – 2023)

Planning Frameworks include sub-elements such as National Disaster Management Plan, Local Governance Plans, Sector-Specific CDM Plans or Supporting Plans and Mutual Aids/Memorandum of Understandings. Within the 2018 CDM Audit, Local Governance was deemed as the weakest sub-element; however, it still attained the acceptable threshold. There is an absence of a local governance structure and therefore no local emergency or disaster committees. As a result, there are no local level committees for key sectors to be represented. Similarly, there is no local government public administrative arm that can facilitate disaster relief efforts via Mutual Aids/Memoranda of Understandings. Overall, the CDM Audit highlighted the following recommendations (as seen in Figure 61) in support of national mitigation efforts under this Priority Area.

**Figure 61: CDM Audit Recommendations in support of National Mitigation Efforts under Priority 2**



Source: Department of Emergency Management

Within its 2020 and 2021 Annual Reports, the DEM outlined a series of initiatives undertaken by the GoB to facilitate Institutional Strengthening. Details regarding these initiatives can be seen in Table 17. Through its Department of Emergency Management, the GoB has spearheaded the development and implementation of the National Comprehensive Disaster Management Country Work Programme (CWP) (2019-2023). This initiative is achieved via the utilization of the integrated management approach which focuses on DRM advocacy; institutional strengthening of the National Emergency Management System; community disaster risk resilience; DRM mainstreaming across key sectors; and the incorporation of science in DRM. This integrated management approach promotes efficiency and effectiveness in the achievement of the DEM's mission to the general populace via the identification and mobilisation of all appropriate resources and detailed planning for the possible impact of any hazard. The adopted approach also encompasses all phases of the disaster management cycle irrespective of the inherent nature of the threat posed. In addition, Barbados hosts the offices of the Caribbean Disaster Emergency Management Agency (CDEMA) and the Regional Security System as the regional inter-governmental agencies for disaster management and security across the Caribbean. These two, amongst others, provide support for the national emergency mechanism.

**Table 17: DRM Initiatives in Barbados to facilitate Institutional Strengthening**

Priority Area	Goal	Name of the Initiative	Overall Objective
Institutional Strengthening for Comprehensive Disaster Management (CDM)	The goal of this programmatic area is to pursue programmes and activities that strengthen the enabling environment for Comprehensive Disaster Management (CDM) and encourage the construction of resilient critical infrastructure	Implementation and Monitoring of the Department of Emergency Management (DEM) Strategic Plan 2019 - 2023	The Strategic Plan 2019-2023 is a shared vision for the field of emergency management and disaster risk reduction in Barbados. It sets an ambitious, yet achievable, path toward advancing emergency management and building resilience across the country for the next five (5) years.
		Relocation of the Department of Emergency Management	The department relocated to a new modern facility at #24 Warrens Industrial Park in July 2020.
		Continued Re-engineering of DEM's Organizational Structure	To build organizational capacity to support the delivery of the DEM mandate.
		Development of an Updated Comprehensive Disaster Management (CDM) Policy	To facilitate a consultative process via support from CDEMA over the periods October 2020-December 2020 and January 2021 - December 2021. Following stakeholder engagements, a revised policy draft is expected to be submitted to the Emergency Management Advisory Council (EMAC) and the cabinet in 2022.
		Finalization of the Updated Comprehensive Disaster Management (CDM) Policy	During 2019, the Department of Emergency Management, with the support of the Caribbean Disaster Emergency Management Agency (CDEMA) and the United Nations Office for Disaster Risk Reduction (UNDRR), completed the Barbados Comprehensive Disaster Management (CDM) Country Work Programme (CWP) 2019-2023. The CWP is a multi-year, results-based programme developed by the partners of the National Emergency Management System (NEMS). Stakeholders agreed on five (5) Programme Areas for work over the next four (4) years. The CWP was officially approved by the Cabinet on January 23, 2020.
		National Logistics Policy Document	With the support of CDEMA, facilitate a series of Logistics and Relief Management Workshops to strengthen logistics and relief management in the following thematic areas: incoming relief supplies, port operations, warehousing and storage, transportation management and last mile distribution systems

Priority Area	Goal	Name of the Initiative	Overall Objective
Institutional Strengthening for Comprehensive Disaster Management (CDM)	The goal of this programmatic area is to pursue programmes and activities that strengthen the enabling environment for Comprehensive Disaster Management (CDM) and encourage the construction of resilient critical infrastructure	Standard Relevant Reviews 2021	The department also conducted a standard review of the Emergency Management Orders 2020 prior to the official start of the hurricane season. This document was then forwarded through The Ministry of Home Affairs and The Office of the Attorney General for final approval by Parliament.
		The Production of the Department's Annual Report	As stipulated by law, the Department submitted its 2020 Annual Report to the Emergency Management Advisory Council for endorsement and later to the Cabinet of Barbados.
		The Development of the Multi-Hazard Early Warning System Roadmap and Action Plan 2021- 2024	With support from CDEMA, implement of the "Strengthening Hydro-Meteorological and Early Warning Services in the Caribbean Project" under the Climate Risk and Early Warning Systems (CREWS) initiative which was funded by the World Bank. Inputs into this project include an assessment report of Barbados' Multi-Hazard Early Warning System (MHEWS) and a National Roadmap and Action Plan for Barbados 2021-2024 following a series of multistakeholder consultations, led by the DEM between the periods March to October 2021.
		Strengthening of the ICT Mechanisms within the Department to Facilitate Improved Business Processes within the Agency	To upgrade its ICT equipment in an effort to improve its operations and business processes.

Source: The Department of Emergency Management: Annual Reports (2020-2021)

Despite these national efforts, gaps still persist in relation to Priority 2 under the Sendai Framework for Disaster Risk Reduction. The GoB is therefore committed to improving operational readiness at the national, sectoral and community levels. The NEMS coordinated by the DEM is operational; however, it must maintain the National Multi-Hazard Disaster Management Plan (NMHDMP) and emergency response mechanisms. Priority will also be given to the enforcement of the national building code and the designation of a national legislative authority to govern these regulations as well as the establishment of programmes to promote greater compliance.

### 5.3 Priority 3: Investing in Disaster Risk Reduction for Resilience

Investing in disaster risk reduction involves the assignment of resources (financial, logistical, human resources) by both public and private entities in support of the disaster risk reduction agenda. Investing in disaster risk includes risk transfer mechanisms, critical infrastructure risk prevention and reduction; land-use mainstreaming; strengthening building codes; health systems resilience; social protection mechanisms for vulnerable groups; integrating disaster risk reduction into environmental management practices and strengthening tourism sector resilience.

According to the 2018 CDM Audit, some critical strengths exist within Barbados' National Disaster Management Framework. These stem from the alignment of its Mitigation Phase of reporting with regional and international standards. For Sendai Priority 3: Investing in Disaster Risk Reduction for Resilience, strengths were noted within risk financing (e.g., financial measures).

#### **Risk Financing**

This mitigation phase is solely comprised of the element financial measures and its sub-element – the private sector. Even though there is a comprehensive insurance coverage for residential and commercial properties that factors in a wide array of hazards, the acquisition of insurance for residential policies is not compulsory by law. There is also a paucity of information regarding the enforcement of insurance and renewal scheduled for business licences – all of which should be linked to national policies such as building codes. There is a paucity of information on crop insurance available to farmers which makes effective planning for inclement/extreme weather conditions very difficult. Risk financing on the island can be disaggregated into domestic and external sources of financing.

#### **Domestic Sources of Financing**

At the domestic level, the DEM has received substantial funding from the GoB to mitigate risks posed by natural hazards and or extreme weather events. Within the national budgetary processes, funds were allocated to the specific disaster prevention sub-program. Prior to 2011, the subprogram devoted to disaster risk reduction efforts fell under the auspices of the Ministry of Finance, Investment, Telecommunications and Energy. Under the purview of Disaster prevention, the sub-program entitled '0560 Catastrophe Fund'

sought to 'provide relief and assistance of persons receiving income less than the income tax limit per annum in respect of damage to owner occupied chattel dwellings or dwelling units of wood/concrete block construction' (Government of Barbados, 2009). Over the period 2009-2011, financial resources dedicated to this Subprogram 0560 Catastrophe fund remained consistent with an annual estimated budget of USD \$1,250,000.00 (BBD \$2,500,000.00).

With a marked change in the political administration and ministerial portfolios, a newly developed programmeresponsibleforemergencypreparedness at the national level was implemented and held under the auspices of the Ministry of Home Affairs and Information. With the primary aim of coordinating Disaster Management programmes and activities not only across the public sector but also on a national scale, the Programme 200: National Emergency Preparedness (Subprogramme 206: Department of Emergency Management) fell under the purview of the DEM. This subprogram sought to facilitate the implementation of programmes and activities in the execution of the island's National CDM Policy and Programme. However, this level of funding represents a 38.33% decline in historic levels achieved under the Subprogram 560 Catastrophe Fund<sup>239</sup>.

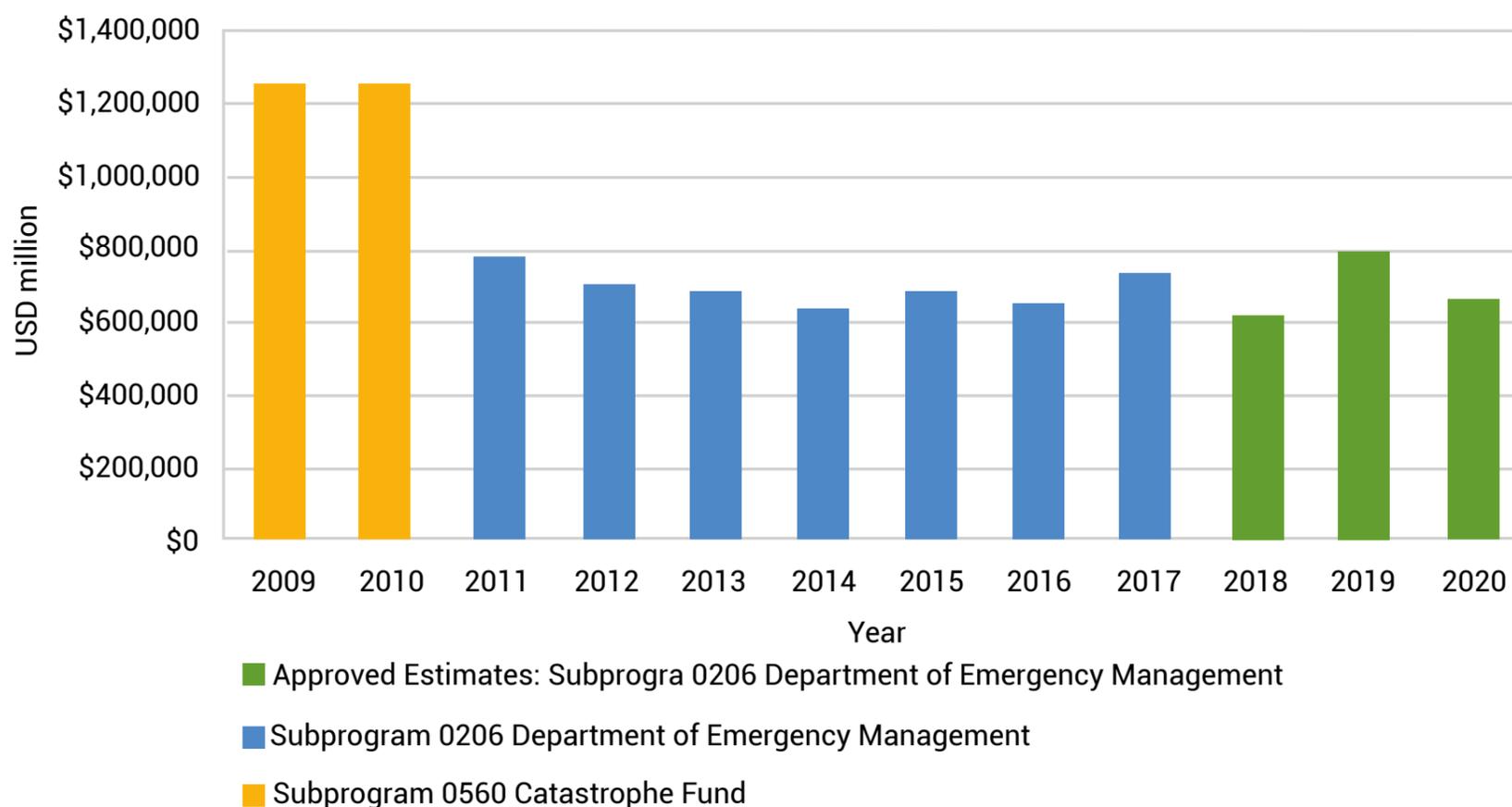
Over the period 2011-2017, the sum of financial resources dedicated to the Subprogram 206 Department of Emergency Management stood at USD \$4,853,060.00 (BBD \$9,706,120.00). Prior to 2015, there were no marked increases in this type of financing as the percentage change in financing was noted by an 8.77% reduction in 2012, followed by a subsequent spike of 5.94% in 2013 and a 6.96% reduction in 2014. The period 2015-2017 is predominantly noted by a sharp rise in financing. Within the year 2015, USD \$688,165.00 (BBD \$1,376,331.00) coincided with a marked 8.25% increase in the level of financing to the department. Similarly, a 12.48% increase in financing for 2017 was also noted. This coincided with an annual estimated budget of USD \$726,248.00 (BBD \$1,452,496.00). However, the department experienced a 6.17% shortfall in the level of financing for the year 2016 - where an annual estimated budget of USD \$645,685.00 (BBD \$1,291,370.00) was recorded.

Over the entire period 2009-2017, the DEM has maintained an annual estimated budget of USD

<sup>239</sup> Subsequent to 2011, Subprogram 560: Catastrophe Fund was replaced by Subprogram 206: Department of Emergency Management.

\$693,294.34 (BBD \$1,386,588.57). The Approved Budgets for 2018-2019, 2019-2020 and 2020-2021 stood at USD \$610,795.00 (BBD \$1,221,590.00); USD \$798,320.00 (BBD \$1,596,639.00); and USD \$666,505.00 (BBD \$1,333,010.00) respectively. Details regarding the Annual Budgetary Expenditure for the subprograms under Disaster Risk Management can be seen in Figure 62.

**Figure 62: Budgetary Expenditure for Disaster Risk Management over the period 2009-2020**



Source: Ministry of Finance

The overall budgetary process for Disaster Risk Management in Barbados has been quite standardized. In terms of disaggregated line items, there are limited variations across the respective subprograms under review. However, it should be noted that there was no disaggregation of estimated budgetary components for the period spanning 2009-2011. Significant changes within Disaster Risk Management line-item expenditures were observed over the period under investigation. Under Total Non-Statutory Capital Expenditure, the largest declines in expenditure changes corresponded to line item 752 'Machines and Equipment' as well as line item 756 'Vehicles' and is representative of a substantial reduction in capital stock. As it relates to Total Non-Statutory Recurrent Expenditure, substantial reductions in expenditure changes associated with line item 208 'Rental of Property' were also observed. Overall, the most substantial rise in expenditure changes was associated with Operating expenses.

According to the 2018 CDM Audit, the preparedness phases of reporting encompassed six (6) themes: (i) Governance, (ii) Education and Information, (iii) Training and Exercises, (iv) Warning and Alerts, (v) Finance and Administration, and (vi) Community Resilience. Within the 2018 CDM Audit, Finance and Administration was identified as the component with the greatest need for priority among all components. On February 19th, 2022, the Barbados Estimates of Revenue & Expenditure were laid in Parliament<sup>240</sup>. Estimates for the 2022-2023 fiscal year include provisions for the following activities:

- A current subvention of BBD \$125.0 million is being provided to the Queen Elizabeth Hospital for its operations in addition to the BBD \$7.99 million for management of the COVID-19 Pandemic;
- Invest Barbados has been allocated the sum of BBD \$7.5 million to carry out its operations;

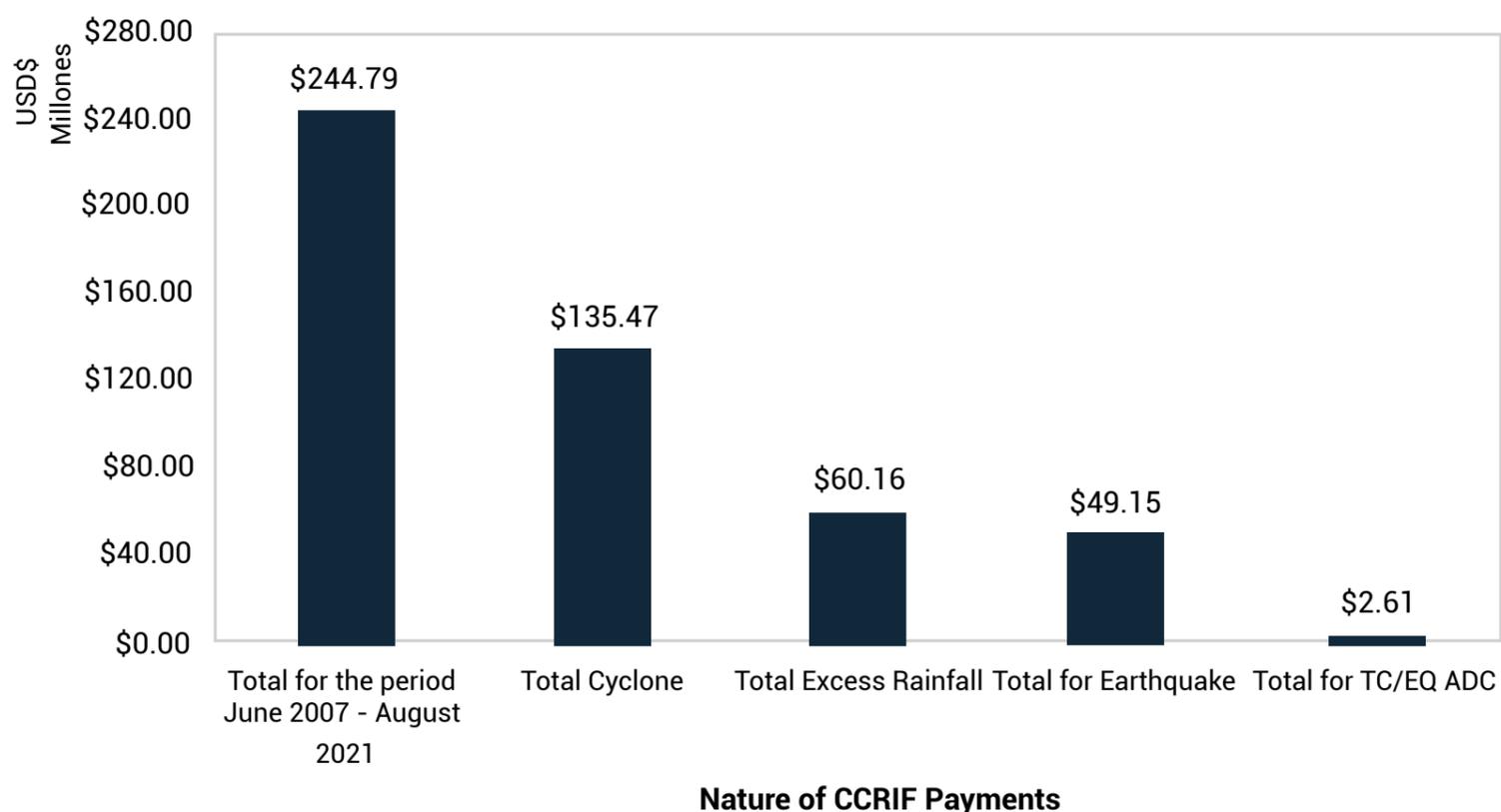
240 BGIS. 2022. "Estimates Of Revenue & Expenditure Laid In Parliament". <https://gisbarbados.gov.bb/blog/estimates-of-revenue-and-expenditure-laid-in-parliament/#:~:text=Overview%202022%2D2023&text=Expenditure%20on%20goods%20and%20services,or%205.6%2-5%20to%20%241%2C059.6%20million.>

- BBD \$6.0 million has been provided for the IDB Road Rehabilitation Programme;
- BBD \$2 million has been provided for the Scotland District Road and Rehabilitation Project to be funded by the Chinese;
- BBD \$7.6 million has been provided for the Latin American Development Bank's (CAF) Road Rehabilitation Project<sup>241</sup>;
- An amount of BBD \$10.0 million has been provided for Programme Management – COVID-19;
- BBD \$11.7 million has been provided to carry out capital works at Secondary Schools;
- BBD \$7.5 million has been provided to the Primary Education Domestic programme;
- An amount of BBD \$30 million has been allocated to the Barbados Water Authority to upgrade its reservoirs and the water distribution network.

### External Sources of Financing

Barbados is a member of the Caribbean Catastrophe Risk Insurance Facility (now CCRIF-SPC), established in 2007. To mitigate the inherit short term cash flow problems experienced by SIDS - particularly in instances following significant catastrophic events, the GoB sought financial assistance from external sources of financing like the regional catastrophe fund – CCRIF-SPC. Such action sought to limit the financial burden posed by the occurrence of natural hazards such as earthquakes, tropical cyclones and excessive rainfall. CCRIF-SPC coverage is divided into various policy types: (i) Earthquake Policies, (ii) Tropical Cyclone policies and (iii) Excessive Rainfall policies; as well as (iv) the newly drafted Tropical Cyclone/Earthquake (TC/EQ) Aggregated Deductible Cover (ADC) payments. Over the period June 2007-August 2021, nineteen (19) Caribbean and Central American governments<sup>242</sup> have been granted access to the funds within this mechanism with the total CCRIF payments to date on tropical cyclone, earthquake and excess rainfall policies amounting to USD \$244,789,789.00 as seen in Figure 63.

**Figure 63: The Sum of CCRIF Payments to all Recipient Countries**



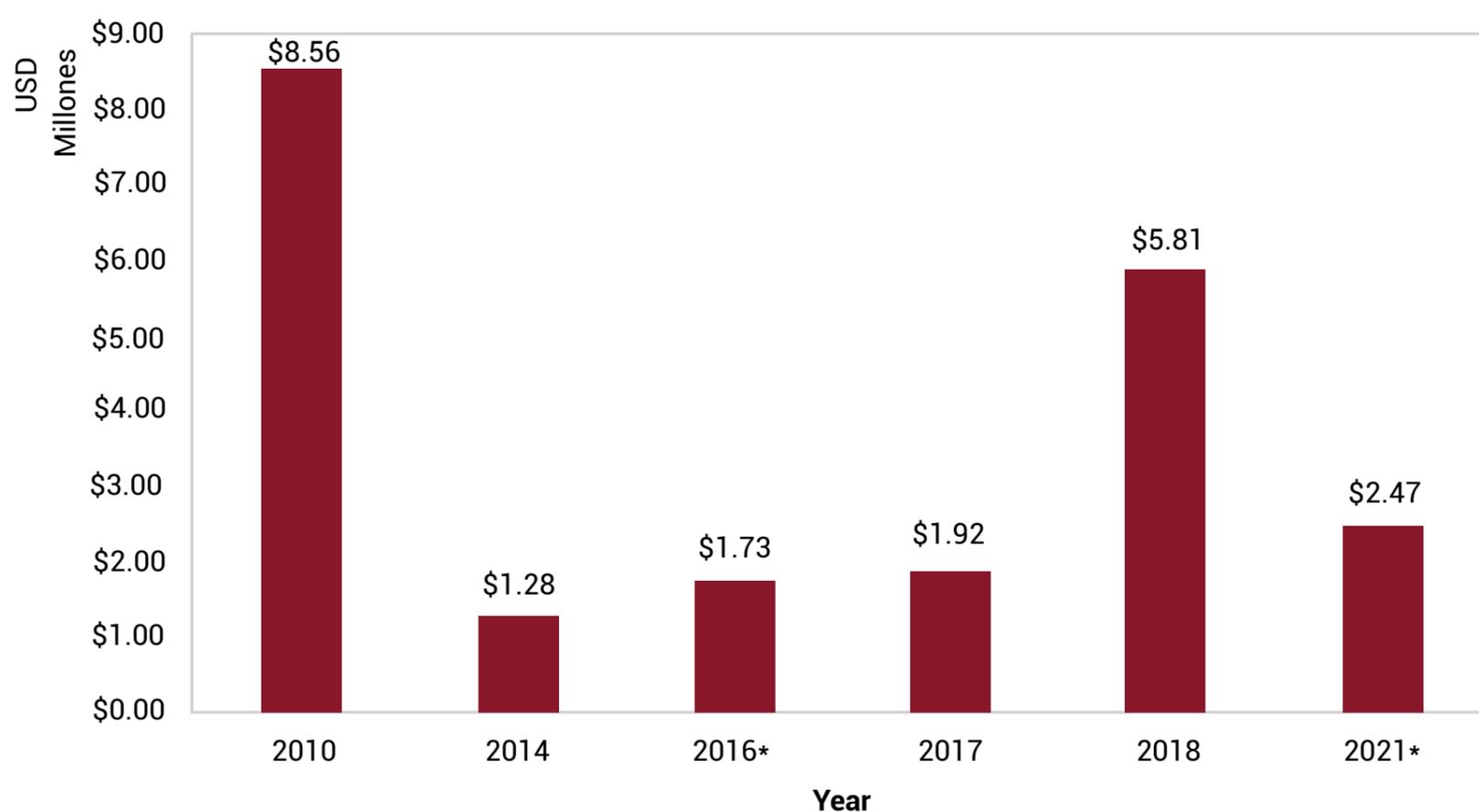
Source: CCRIF-SPC Regional Database

241 BGIS. 2022. "Massive Road Rehabilitation & Improvement Projects To Begin Soon". <https://gisbarbados.gov.bb/blog/massive-road-rehabilitation-improvement-projects-to-begin-soon/>

242 Nineteen Caribbean governments are currently members of the Facility: Anguilla, Antigua & Barbuda, Bahamas, Barbados, Belize, Bermuda, British Virgin Islands, Cayman Islands, Dominica, Grenada, Haiti, Jamaica, Montserrat, St. Kitts & Nevis, Saint Lucia, Sint Maarten, St. Vincent & the Grenadines, Trinidad & Tobago and Turks & Caicos Islands. Three Central American governments are currently members of the Facility: Guatemala, Nicaragua, and Panama. One electric utility company is currently a member of the Facility: ANGLEC.

Since October 2010, Barbados has received seven (7) substantive payments totalling USD \$21,774,135.00 (BBD \$43,548,270.00) as seen in Figure 64 - representative of 8.9% all CCRIF-SPC pay-outs since the inception of the multi-country risk pool mechanism in 2007. Primarily, these payments to Barbados alleviated pressure on the public budget. In August 2019, Barbados also received a payment under the Tropical Cyclone/Earthquake (TC/EQ) Aggregated Deductible Cover (ADC) for USD \$123,500.00 (BBD \$ 247,000.00) following the passage of Tropical Cyclone Dorian. This amounted to 4.91% of all Tropical Cyclone payments under the ADC and 4.74% of all ADC payments issued. In 2010, Barbados sought financial assistance from the CCRIF-SPC to deal with the devastation following the passage of Tropical Cyclone Tomás. This payout amounting to USD \$8,560,247.00 (BBD \$17,120,494.00) is highly significant not only because it represents the biggest payout to Barbados, but also because its sum was only surpassed by two territories in other instances - payments to Turks and Caicos following the passage of Tropical Cyclone Irma in September 2017, and payments to Haiti in October 2016 following the passage of Tropical Cyclone Matthew.

**Figure 64: Total CCRIF Payments to Barbados, 2010-2021**



Source: CCRIF-SPC Regional Database

\*The year 2016 is noted by two payments: (i) Tropical Cyclone policy amounting to USD\$0.975 million and (ii) an Excessive Rainfall policy amounting to USD\$753,277.00. \*The year 2021 is noted by two payments: (i) Tropical Cyclone policy amounting to USD \$1,345,500.00 and (ii) an Excessive Rainfall policy amounting to USD \$1,124,424.00

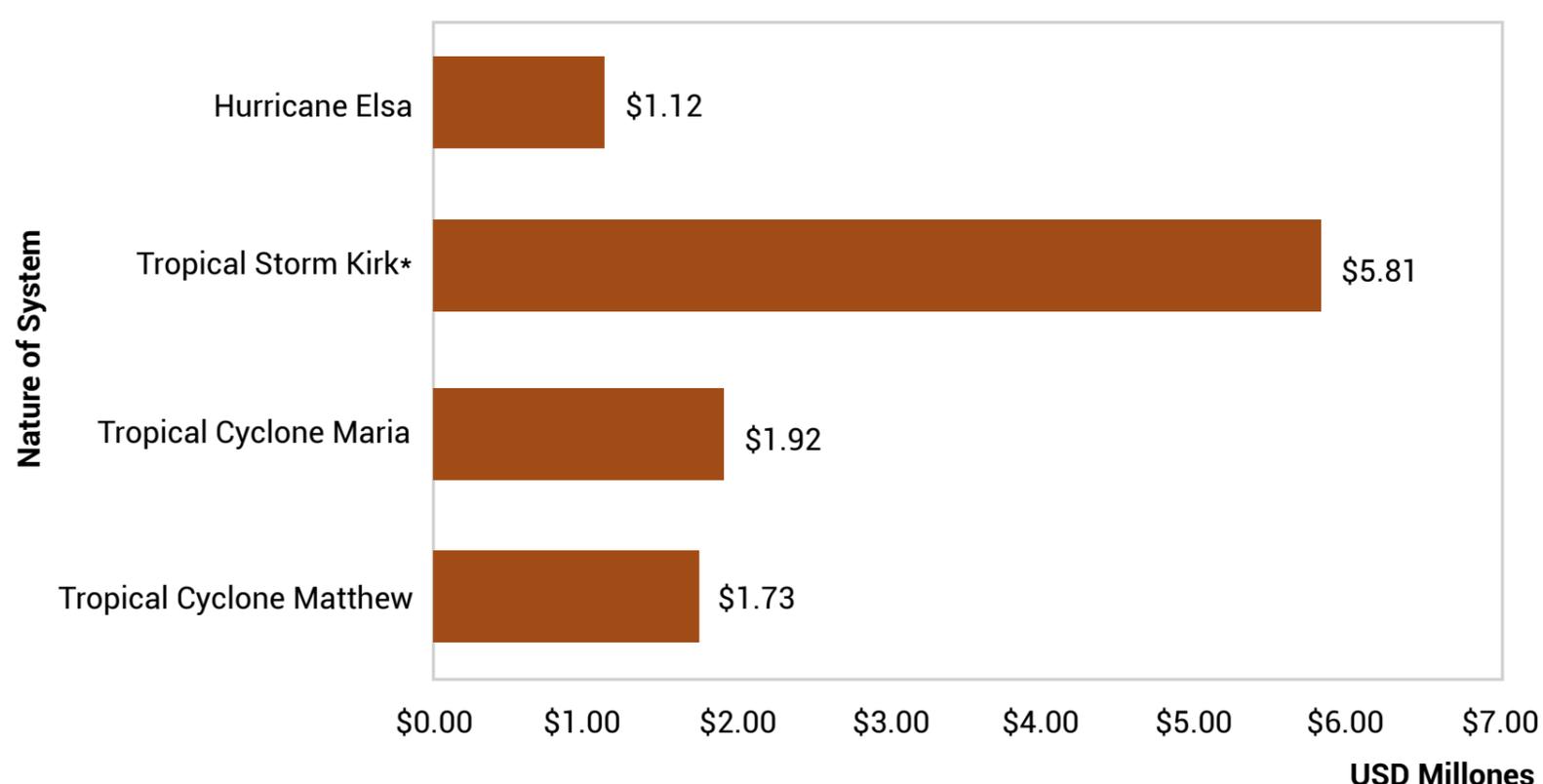
In 2018, Barbados was the first recipient of CCRIF-SPC financing having received another substantive CCRIF-SPC payment of USD \$5,813,299.00 (BBD \$11,626,598.00) following the passage of Tropical Storm Kirk. Citing concerns over Barbados' predominantly reactive stance to DRM, the CDEMA has urged the GoB to restore its catastrophe fund to its previous levels as the current state of affairs lends to the potential depletion of financial resources and its almost complete reliance on external sources of financing for non-catastrophic events. More recently in 2021, CCRIF-SPC made its first Parametric Insurance Payouts of the 2021 Atlantic Hurricane Season to Barbados following the passage of Hurricane Elsa. This level of financing amounted to approximately USD \$2.5 million (approximately BBD \$5 million) and facilitated disaster relief efforts under the country's tropical cyclone and excess rainfall parametric insurance policies.

Relief in Barbados has been predominantly sought to deal with excessive flooding. Over the period 2016-2021, Barbados received payments amounting to USD \$9,608,506.00 (BBD \$19,217,012.00) - representative

of 15.97% of all CCRIF-SPC excessive rainfall policies to date (USD \$60,161,835.00 or BBD \$120,323,670.00) as seen in Figure 65. These funds were used to provide disaster relief in the aftermath of the following hydrometeorological hazards:

- Tropical Cyclone: Matthew (USD \$1,728,227.00 or BBD \$3,456,554.00);
- Tropical Cyclone: Maria (USD \$1,917,506.00 or BBD \$3,835,012.00);
- Tropical Storm Kirk (USD \$5,813,299.00 or BBD \$11,626,598.00); and
- Hurricane Elsa (USD \$1,124,424.00 or BBD \$2,248,848.00).

**Figure 65: CCRIF Payments to Barbados for Excess Rainfall Coverage over the period 2016-2021**



Source: CCRIF-SPC Regional Database

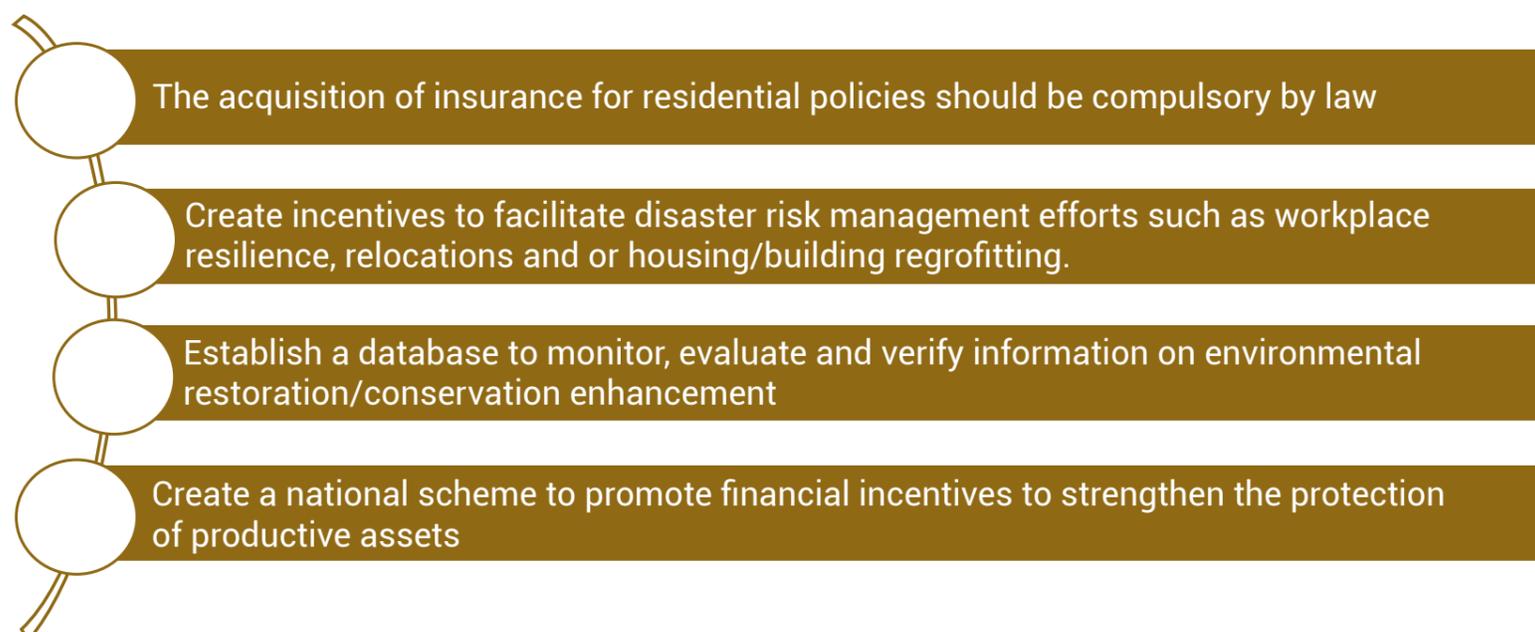
According to the 2018 CDM Audit, some critical strengths exist within Barbados' National Disaster Management Framework exist. These stem from the alignment of its Mitigation Phase of reporting with regional and international standards. For Sendai Priority 3: Investing in Disaster Risk Reduction for Resilience, strengths were noted within structural mitigation (e.g., new and old facilities). However, the country's performance on the non-structural mitigation component was deemed as unsatisfactory.

### **Non-Structural Mitigation**

This consists of four elements: (i) Land Use Planning, (ii) Safety Standards, (iii) Building Codes, and (iv) Incentives – the latter two of which represent major areas of special attention as the level of performance of these measures was deemed as unsatisfactory. As it relates to Priority 3: Investing in Disaster Risk Reduction for Resilience, there were currently no incentives to facilitate disaster risk management efforts such as workplace resilience, relocations and or housing/building retrofitting. There is also a lack of information on environmental restoration, conservation enhancement or the existence of a national scheme to promote financial incentives to strengthen the protection of productive assets (livestock, working animals, tools, and disaster resilient seedlings).

Overall, the 2018 CDM Audit highlighted the following recommendations (as seen in Figure 66) in support of national mitigation efforts under this Priority Area.

**Figure 66: CDM Audit Recommendations in support of National Mitigation Efforts under Priority 3**



Source: Department of Emergency Management

Within its 2020 and 2021 Annual Reports, the DEM outlined a series of initiatives undertaken by the GoB to facilitate Investments in Disaster Resilience. Details regarding these initiatives can be seen in Table 18.

**Table 18: DRM Initiatives in Barbados to facilitate Investments in Disaster Resilience**

Priority Area	Goal	Name of the Initiative	Overall Objective
External Relations	The goal of this programme is to actively promote cooperation and collaboration between Barbados and external partners, with a view of advancing the national disaster risk management programme <sup>243</sup> .	World Meteorological Organisation (WMO) – Climate Risk and Early Warning Systems (CREWS)	To conduct a three-year project that seeks to strengthen and streamline regional and national systems and capacity related to weather forecasting, hydrological services, multi-hazard impact-based warnings and service delivery for enhanced decision-making in the Caribbean – particularly amongst CARICOM Member States. Led by the World Bank Global Facility for Disaster Reduction and Recovery (GFDRR), the project targets both regional and national level priority areas to comprehensively strengthen hydromet services and Early Warning Systems (EWS) across the region.
		Inter-American Development Bank (IDB) – Government of Barbados Sustainable Development Policy Programme/ Contingent Loan for Natural Disaster (sic) Emergencies (BA - L1048 & BA - 00004)	To participate in a series of meetings on the initiative to pursue IDB Policy based Loans for Barbados as well as the Contingent Credit Facility. The department also produced and submitted progress reports on the DEM-led obligations under these policy programmes and loan arrangements.

<sup>243</sup> Historically, the Ministry of Foreign Affairs has played a facilitating role in this area and it is envisaged that it would continue as necessitated. The DEM sees it necessary to continue strengthening bilateral relationships with regional and international partners, in an effort to enhance capacity to address matters relating to emergency management and information sharing by experts.

Priority Area	Goal	Name of the Initiative	Overall Objective
External Relations	The goal of this programme is to actively promote cooperation and collaboration between Barbados and external partners, with a view of advancing the national disaster risk management programme	Inter-American Development Bank (IDB) – Government of Barbados Technical Co-operation Programme (BA-T1068)	To promote technical cooperation at the international level which focused on improving institutional frameworks for integrated coastal zone management, national risk management planning systems and sustainable climate resilient coastal infrastructure.
		Barbados – UNESCO IOC Intergovernmental Coordination Group (ICG) – Caribbean Tsunami Information Centre (CTIC)	To provide technical support in the areas of tsunami disaster risk reduction across Tsunami prone areas in Barbados (North Western and South Eastern coastlines)
		Barbados – Caribbean Disaster Emergency Management Agency (CDEMA)	To make an annual contribution to CDEMA as a Participating State and in return directly benefit from disaster management technical assistance projects, resource mobilisation and support during a hazardous impact.
		Barbados – United Nations Relations: UN Environment/ OCHA Environmental Emergencies Centre	To participate in monthly Environmental Emergencies Network Meetings which focused on capacity building and developmental opportunities for Network members, establishing rules of operations of the Network, work programme implementation and reporting with respect to environmental emergencies network's agreed to priorities.
		Courtesy Call and Technical Exploratory Meetings	To actively participate in a series of Courtesy Calls and Technical Exploratory Meetings at the national, regional and international levels.
		Regional Security System (RSS)	To facilitate the participation of DEM and other NEMS agencies in a RSS tabletop exercise focused on national and regional emergency response systems.
		DEM - US Military Liaison Office (MLO)	To develop proposals under the Humanitarian Assistance Programme and the Minimal Cost Project Programme. These projects sought to acquire additional equipment for emergency operations and the installation of shutters at an emergency shelter.

244 The UN Environment Programme (UNEP)/UN Office for the Coordination of Humanitarian Affairs (OCHA) Joint Environment Unit (JEU) was established in 1994 as the United Nations mechanism to mobilise and coordinate emergency assistance to countries affected by environmental emergencies and disasters with significant environmental impact. The Joint Unit mobilises technical expertise to deploy to emergencies and also works on readiness for response and risk reduction, primarily through knowledge sharing, trainings and the development of tools and guidance.

Priority Area	Goal	Name of the Initiative	Overall Objective
External Relations	The goal of this programme is to actively promote cooperation and collaboration between Barbados and external partners, with a view of advancing the national disaster risk management programme	Donations to Support COVID-19 Response	To receive the donation of Personal Protection Equipment (PPE) from the Jack Ma Foundation, Caribbean Development Bank (CDB), World Health Organization (WHO) and United Arab Emirates (UAE). These donations were facilitated through the CDEMA with the sole purpose of assisting the DEM in its fight against the COVID-19 Pandemic.
		United States Embassy Military Liaison Office (MLO)/ Barbados Relations	To be earmarked as the venue for Tradewinds 2021. Tradewinds is a US Southern Command sponsored Caribbean focused training exercise designed to help participants better respond to disasters and land and maritime threats. The exercise includes U.S. military and Security agency personnel who will train with counterparts from twenty-one partner nations.
		DEM – Caribbean Institute for Meteorology and Hydrology (CIMH) Relations	To collaborate on disaster management initiatives across the Caribbean Basin.
		DEM-Barbados Canada Association (BCA) Relations	To solidify a partnership between the DEM and the Barbados Canada Association via the signing of a Memorandum of Understanding (MOU) to garner support on matters related to disaster risk management and humanitarian assistance.
		Barbados – Martinique	To facilitate technical assistance across Caribbean Member States and leverage inherit knowledge regarding the hazards posed during volcanic eruptions.
		Barbados – Columbia	To discuss technical cooperation between the two (2) countries with a focus on DRM.

Source: The Department of Emergency Management: Annual Reports (2020-2021)

Despite these national efforts, gaps still persist in relation to Sendai Priority 3: Investing in Disaster Risk Reduction for Resilience. The GoB aims to be transformational by adopting a holistic and programmatic approach at a scale commensurate with the challenges faced on the national front. Whilst considering the existing budgetary and financial constraints, financing climate action in Barbados will rely in part upon new and additional sources of climate funding and increasing flows of international finance<sup>245</sup> towards sustainable investment – particularly enhanced funding to support loss and damage.

<sup>245</sup> Barbados Today. 2022. 'Region to get funding for resilience efforts'. <https://barbadostoday.bb/2022/10/13/region-to-get-funding-for-resilience-efforts/>

Within its 2021 Update of the Nationally Determined Contributions (NDC) to the UNFCCC<sup>246</sup>, the GoB emphasized the importance of integrating Sustainable (Blue and Green) Finance into the core adaptation and loss and damage financial package for the protection and enhancement of natural capital and preservation of threatened resource endowment. The government will also explore different financial instruments that do not further increase sovereign debt, such as a special purpose investment vehicle or green bond to attract financing for the implementation of the desired projects and initiatives.

Barbados is committed to contributing to discussions on international cooperation through Article 6 of the Paris Agreement which recognizes that some Parties may choose to pursue voluntary cooperation to facilitate the implementation of their Nationally Determined Contributions (UNFCCC, 2022). Such actions will facilitate higher ambition in Barbados' mitigation and adaptation actions therefore promoting sustainable development and environmental integrity. There is also a need to apply innovative instruments and tools while the government works to ensure that barriers to NDC-aligned investments are removed.

#### 5.4 Priority 4: Enhancing Disaster Preparedness for Effective Response to "Build Back Better" in Recovery, Rehabilitation and Reconstruction

Pre-disaster preparedness must be strengthened to facilitate improvements in response and recovery. For Barbados, the Preparedness phases of reporting encompassed six (6) themes: (i) Governance, (ii) Education and Information, (iii) Training and Exercises, (iv) Warning and Alerts, (v) Finance and Administration, and (vi) Community Resilience. Some exceptional strengths existed within the Preparedness phase of the Barbados' National Disaster Management Framework during the 2018 CDM Audit. Such strengths stemmed from the alignment of various themes<sup>247</sup> within the island's Preparedness Phase of reporting with regional and international standards. For Sendai Priority 4, strengths were noted within (i) Warning and Alerts, (ii) Training and Exercises; as well as (iii) Community Resilience.

<sup>246</sup> Government of Barbados. 2021.

<sup>247</sup> Preparedness phases of reporting encompassed six (6) themes: (i) Governance, (ii) Education and Information, (iii) Training and Exercises, (iv) Warning and Alerts, (v) Finance and Administration, and (vi) Community Resilience.

#### Warnings and Alerts

Within the 2018 CDM Audit, this component performed exceptionally well having attained a score of 2.61. Warning and Alerts therefore constitutes a notable strength on the national scale. It is comprised of the following three (3) elements: (i) Detection, (ii) Emergency Communications; and (iii) Early Warning Systems (EWS). The former two of which were deemed as satisfactory – attaining scores of 3.00. However, the element: Early Warning Systems performed unsatisfactorily - having attained a score of 1.84 at the time of the 2018 CDM Audit.

Detection, which represents an important aspect of the Preparedness phase, is associated with one (1) sub-element: Hazard specific methodology/technology. On the island, this is noted by the existence of a national EWS for hydrometeorological hazards. This particular EWS facilitates both national and regional forecasting capabilities for tropical storms and tropical cyclones (hurricanes). Emergency Communications also represents another important aspect of the Preparedness phase. It is associated with one (1) sub-element: Technologies/systems protocols which attained a score of 2.75 at the time of the 2018 CDM Audit. All of the subsidiary standards under this element were completely met. These include:

- i. The existence of robust, resilient and redundant emergency communications systems that provide immediate warning, mass notification and inter-operability in existence;
- ii. The availability of emergency communication networks to the NEOC to provide immediate warning, mass notification and inter-operability;
- iii. The availability of emergency communication networks at the local level to provide immediate warning, mass notification and inter-operability; and
- iv. The existence of protocols for emergency communications at the national and local levels.

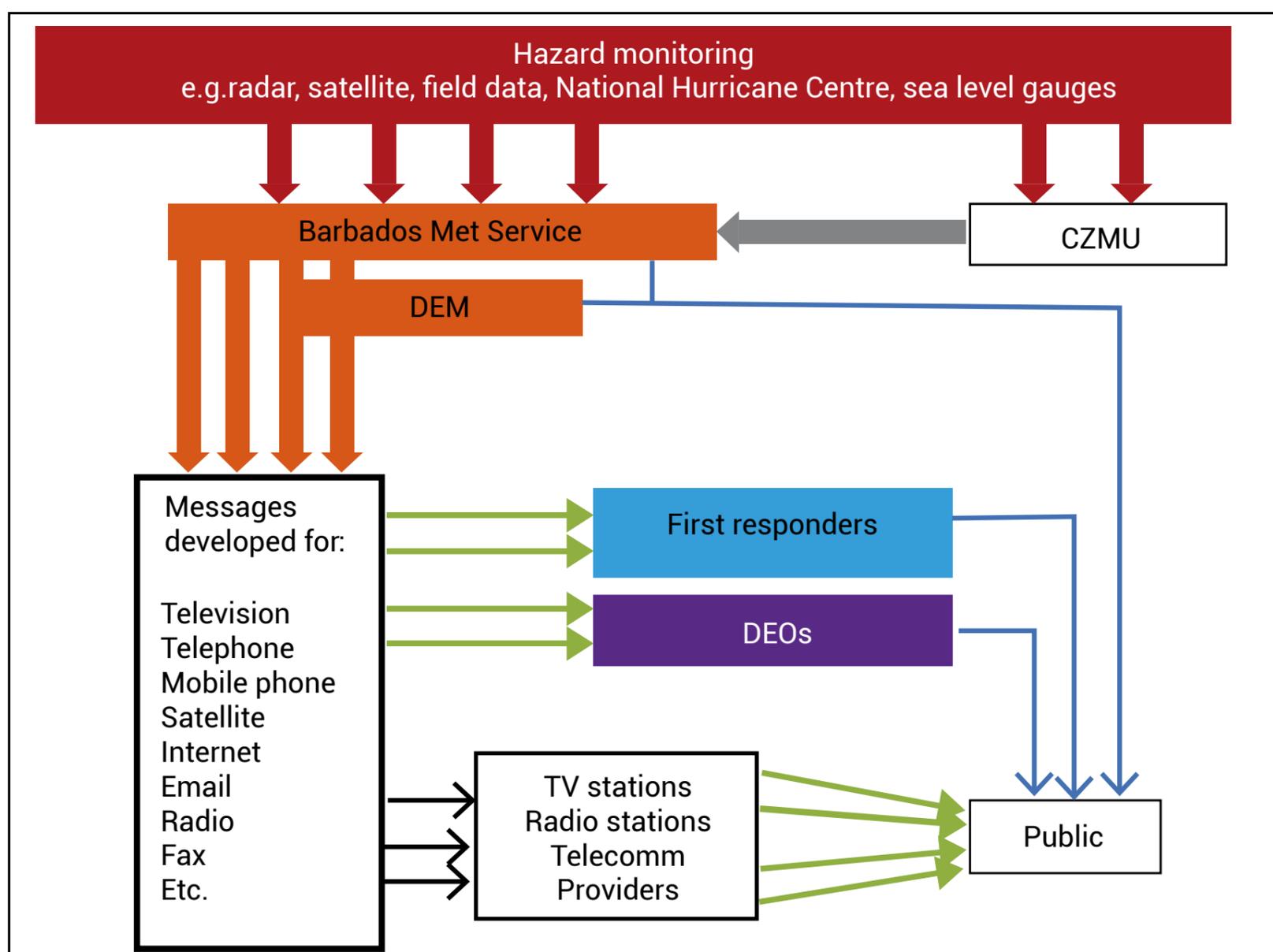
The development of a national EWS is aligned with UNDRR's strategic objective<sup>248</sup> of attaining 'zero

<sup>248</sup> UNDRR. 2022. 'A world with zero climate disasters needs early warnings for all'. <https://www.undrr.org/news/world-zero-climate-disasters-needs-early-warnings-all>

climate disasters by 2030', UNDRR, 2022). However, there was a weak Multi-Hazard Early Warning System (MHEWS) at the time of the 2018 CDM Audit<sup>249</sup>. This therefore represented a notable weakness in national preparedness efforts across all intra-related and inter-related hazards. The element: Early Warning Systems is comprised of two (2) sub-elements: (i) Technology/Systems for Alerting; (ii) Safe Area which achieved scores of 2.43 and 1.25, respectively. This is indicative that improvements in the efficiency and effectiveness of EWS on the island are warranted. A schematic of the Barbados National EWS is depicted in Figure 67. Intra-island and inter-island hazards are monitored by three main entities on the island: the Barbados Meteorological Service, the Coastal Zone Management Unit (CZMU); and the National Disaster office: The Department of Emergency Management (DEM).

Of the eight (8) subsidiary standards for the sub-element: Technology/Systems for Alerting, only four (4) national alerts systems were deemed as highly developed. These include: (i) tsunamis<sup>250</sup>, (ii) strong motion detection, (iii) pandemic, as well as (iv) plant and animal zoonoses. National alerts for droughts and volcanoes need to be improved. Even though Barbados is not classified as volcanic in nature, it has been subjected to intra-island volcanogenic hazards like ashfall from Montserrat and Saint Vincent and the Grenadines (See Section 2.1.2). Overall, there was a general lack of monitoring regarding the Barbadian population's level of awareness and recognition of EWS during the 2018 CDM Audit.

**Figure 67: A schematic of the Barbados National Early Warning System**



Source: The Department of Emergency Management, 2014

249 Loop News. 2022. 'Development of Early Warning Policy in advanced stage'. <https://barbados.loopnews.com/content/development-early-warning-policy-advance-stage>

250 Barbados Today. 2022. 'Authorities test Tsunami Warning System'. <https://barbadostoday.bb/2021/03/12/authorities-test-tsunami-warning-system/>

In light of such, the GoB conducted a Multi-Hazard Early Warning System (MHEWS) Audit in 2021 and produced a MHEWS Gap Analysis Report for Barbados<sup>251</sup>. One of the other products of the process was the Barbados Multi-Hazard Early Warning System (MHEWS) Roadmap and Action Plan (2021-2024)<sup>252</sup> which underscored its commitment to disaster resilience efforts on the national and local scales (See Section 5.5). One of the key areas prioritized within the MHEWS Roadmap and Action Plan was the development of a National MHEWS Policy. This policy was prioritized in an attempt to ensure that there was strategic guidance for the MHEWS Programme. The GoB has also employed several efforts to increase public sensitization on Disaster Preparedness, Response and Mitigation Capacity Strengthening (as seen in Appendix X).

For the sub-element: Safe Area, there were four (4) subsidiary standards. At the timing of the 2018 CDM Audit, there was a paucity of information regarding clearly designated routes for evacuations, emergency response and hurricane shelters. However, along beaches, there was the existence of information regarding tsunamis and evacuation routes associated with this hazard. Since the administration of the 2018 CDM Audit, there have been deliberate efforts to expand the tsunami-related signage via the Tsunami Ready Recognition Programme<sup>253</sup>.

### Training and Exercises

Within the 2018 CDM Audit, this component performed exceptionally well having attained a score of 2.58. Training and Exercises is comprised of the following three (3) elements: (i) Formal and Informal CDM Training courses; (ii) Community Resilience Enhancement and (iii) Exercises. The former two of which performed exceptional well during the 2018 CDM Audit attaining a score of 3.00 whereas Exercises was deemed as the weakest element under this component. The sub-elements of Formal and Informal CDM Training courses which includes the public and private sectors were completely met. Within the Public sector, the subsidiary standards emphasized the existence of a CDM training strategy and programme that was currently being implemented at the time of the 2018 CDM Audit. In addition to this, the existence of staff

training across all levels and various thematic areas (Human Resource Development; Financial and Project Management; Advocacy and Negotiations; as well as Disaster Management) sought to aid in local response agency efforts. Within the Private sector, the subsidiary standards indicated that the Department of Emergency Management has developed programmes to facilitate CDM training across key sectors (like the private sector) and civil society organizations (Community Based Organisations (CBOs) and Faith Based Organizations (FBOs)).

The sub-element of Exercises which includes the National scale as well as Community and Local scales were partially met. On the National scale, this was informed by the existence annual exercises conducted for a Multi-Hazard National Response Plans as well as annual exercises/simulations conducted for DM plans for the EWS Response Plan, preparedness plans, evacuation plans, contingency plans and Standard Operating Procedures (SOPs). All activities on the national scale engaged a diverse range of stakeholders across various sectors that actively participated in annual national simulation exercises for priority hazards. On the Local and Community Scales, annual exercises/simulations are conducted for DM plans for the EWS Response Plan, preparedness plans, evacuation plans, contingency plans and Standard Operating Procedures (SOPs) - but to a lesser extent than that achieved on the national level as there is no local governance mechanism on the island. All activities on the local and community scales engaged a diverse range of stakeholders across key sector facilities (e.g., schools, hospitals, medium-sized and large hotels) that actively participated in annual national simulation exercises for relevant hazards.

The sub-element of Community Resilience Enhancement which only includes Training of officials and CDM Planning was completely met. This sub-element was associated with three (3) subsidiary standards: (i) CDM Familiarization across all-of-society; (ii) Community engagements via disaster management programmes and (iii) DEM'S Capacity Building efforts across community and local scales.

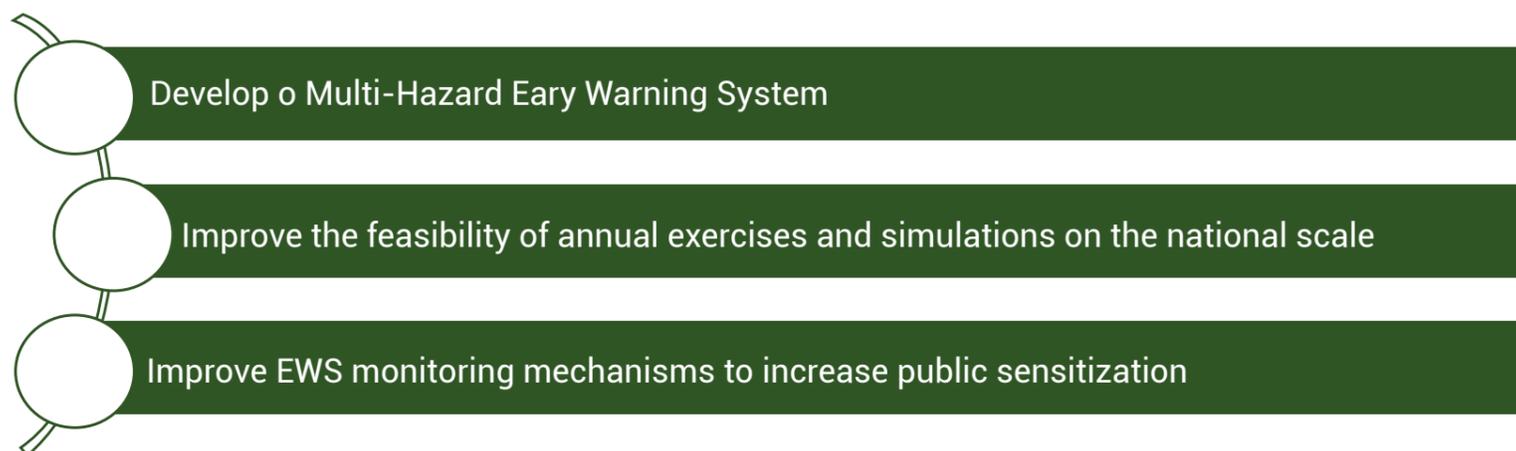
Overall, the 2018 CDM Audit highlighted the following recommendations (as seen in Figure 68) in support of national preparedness efforts.

251 CDEMA, DEM. 2021. "The Multi-Hazard Early Warning Systems: Gap Analysis Report – Barbados (2021)".

252 DEMA, DEM. 2021. "The Multi-Hazard Early Warning Systems Roadmap and Action Plan: Barbados (2021-2024)".

253 BGIS, 2022. "Barbados Has Capacity To Detect Impending Tsunamis". <https://gisbarbados.gov.bb/blog/barbados-has-capacity-to-detect-impending-tsunamis/>

**Figure 68: CDM Audit Recommendations in support of National Preparedness Efforts under Priority 4**



Source: Department of Emergency Management

Within its 2020 and 2021 Annual Reports, the DEM outlined a series of initiatives undertaken by the GoB to facilitate National Preparedness Efforts. Details regarding these initiatives can be seen in Table 19.

**Table 19: DRM Initiatives in Barbados to facilitate National Preparedness Efforts**

Priority Area	Goal	Name of the Initiative	Overall Objective
Preparedness, Response and Mitigation Capacity Strengthening	The goal of this programme is to promote enhanced operational readiness <sup>254</sup>	Annual Emergency Management Policy and Operational Discussions	To ascertain the state of national preparedness for the upcoming Atlantic Hurricane Season. Such discussions involve various members of the Cabinet, Ministry, department and statutory corporation heads as well as other stakeholders who function in the NEMS.
		COVID-19 Pandemic	To monitor and respond to the threat posed to the nation by the COVID-19 pandemic. The DEM supported the national level COVID-19 planning and response. Support was rendered in the area of plan review, strategic emergency management advice to the Cabinet of Barbados, Ministry of Health led Emergency Operations Centre and by the activation of the DEOs to support information collection and dissemination in communities island wide. The Dem also embarked on an initiative to facilitate the distribution of COVID-19 supplies. The DEM also actively participated in regional level discussions led by CDEMA and CARPHA.
		Emergency Management Sensitisation and Training	To heighten the awareness of public servants to the need for their respective ministries and departments to have written evacuation plans. Such discussions involve various members of the Cabinet, Ministry, department and statutory corporation heads as well as other stakeholders who function in the NEMS.
		Emergency Management Advisory Council meetings	To conduct the Working Meetings of the EMAC (in-person or virtually).

<sup>254</sup> This will be achieved via a sustained National Emergency Management System; an approved, tested and updated National Emergency Management Plan and related procedures; enhanced first responder capacities; as well as the mainstreaming and strengthening of CDM knowledge and capabilities within the entire national system.

Priority Area	Goal	Name of the Initiative	Overall Objective
Preparedness, Response and Mitigation Capacity Strengthening	The goal of this programme is to promote enhanced operational readiness <sup>255</sup>	Draft National Hazard Mitigation Policy	To draft a national policy and present it to the EMAC.
		Technical Services to the EMAC Technical Standing Committees and other National Level Multi-Agency Committees	To coordinate activities with the National Emergency Management System's EMAC and its sixteen (16) standing committees in efforts to sensitize the public to the types of hazards to which they are prone so that they can better prepare for them
		Refinement and Approval of National Emergency Management Plan Components	To refine and to seek approval on the National Emergency Management Plans and Standard Operating Procedures from the designated National authorities and ultimately, the Cabinet of Barbados particularly in the context of the COVID-19 pandemic via a series of National Curfew Directives.
		The Management of Mass Crowd Events	To support the congregation of persons resulting from planned or unplanned mass crowd events via emergency management planning and response support.
		Common Alerting Protocol (CAP)	To ensure that the enhanced public warning and alerting network facilitates automated integration with the DEM's social media networks therefore allowing for the synchronized dissemination of emergency alerts across various social media platforms.
		Exercising of Plans and Procedures	<ul style="list-style-type: none"> <li>• National Oil Spill Exercise</li> <li>• Exercise Region Rap 2020</li> <li>• Caribe Wave 2020</li> <li>• National Exercise 2019-2020</li> <li>• Exercise SYNERGY 2020</li> <li>• Damage Assessment and Needs Analysis (DANA)</li> <li>• Exercise Montgomery</li> </ul>
		Signing of Memorandum of Understanding (MOU) - Roving Response Team	To solidify a twenty-seven (27) year partnership with the Roving Response Team (RRT).
		Signing of Memorandum of Understanding (MOU) - Food and General Supplies Committee	To solidify a partnership chaired by the Ministry of Agriculture and Food Security with various private sector distribution centres aimed at increasing their quantities of stock on island during the Atlantic hurricane season.

255 This will be achieved via a sustained National Emergency Management System; an approved, tested and updated National Emergency Management Plan and related procedures; enhanced first responder capacities; as well as the mainstreaming and strengthening of CDM knowledge and capabilities within the entire national system.

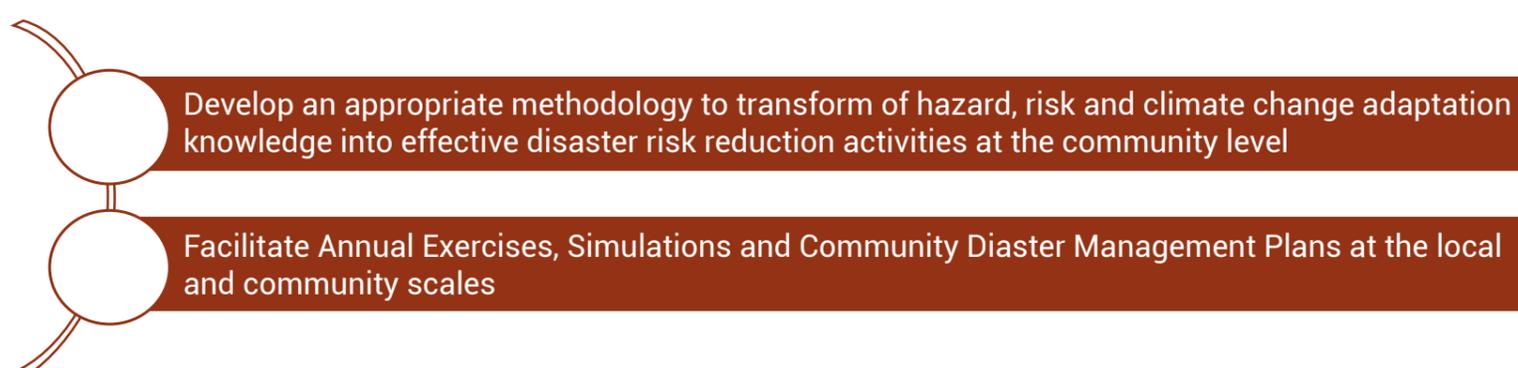
### Community Resilience

For Sendai Priority 4, an adequate measure of strength was noted within Community Resilience during the 2018 CDM Audit. This component performed exceptionally well having attained a score of 2.67. Community Resilience is comprised of one element: The Concept of Community Resilience. This is subdivided into two (2) sub-elements: (i) National Level; and (ii) Community Level Organizations. Both sub-elements attained satisfactory scores; however, only the subsidiary standard at the national level was completely met. This subsidiary standard involved the adaptation of the Sendai Framework for Disaster Risk Reduction by a CDEMA Participating State like Barbados and the integration of DRM at the community level within the national system.

Disaster risk reduction demands a bottom-up approach to be effective. However, during the 2018 CDM Audit, subsidiary standards for Community Level organizations were partially met. This is informed by the existence of a well-defined comprehensive community resilience programme, civil society engagements and committees. This therefore emphasizes the importance of the sixteen (16) Standing Committees; the thirty (30) District Emergency Organizations (DEOs) and auxiliary bodies like the Roving Response Team (RRT); the Barbados Citizens Band Association (BCBRA); the Amateur Radio Society of Barbados (ARSB) and the Barbados Red Cross Society (BRCS). A strong Public Awareness and Education (PAE) systems must therefore be maintained and strengthened. However, there is a lack of appropriate methodology to aid in the transformation of hazard, risk and climate change adaptation knowledge into effective disaster risk reduction activities at the community level.

Overall, the 2018 CDM Audit highlighted the following recommendations (as seen in Figure 69) in support of Community Resilience.

**Figure 69: CDM Audit Recommendations in support of Community Resilience under Priority 4**



Source: Department of Emergency Management

Within its 2020 and 2021 Annual Reports, the DEM outlined a series of initiatives undertaken by the GoB to strengthen Community Resilience. Details regarding these initiatives can be seen in Table 20.

**Table 20: DRM Initiatives in Barbados to strengthen Community Resilience**

Priority Area	Goal	Name of the Initiative	Overall Objective
Strengthening Community Resilience	The goal of this programme is to empower communities across Barbados to be more resilient <sup>256</sup>	Tsunami Ready Programme	To ensure the good maintenance of adequate signage at strategic points along coastlines - particularly along the South Eastern and North Western coastlines.
		DEM – District Emergency Organisations (DEOs) Interface	To conduct a series of training workshops aimed at building capacities within administrators across different community groups as demarcated by the national political constituencies

<sup>256</sup> This will include strengthened community mitigation, preparedness and response, as well as the sustainment of community livelihoods through effective risk management. In addition, the programme is to strengthen the human resource capacity of DEM, emergency response personnel and community volunteers through targeted training and development programmes

Priority Area	Goal	Name of the Initiative	Overall Objective
Strengthening Community Resilience	The goal of this programme is to empower communities across Barbados to be more resilient <sup>257</sup>	Tsunami Ready Programme	To ensure the good maintenance of adequate signage at strategic points along coastlines - particularly along the South Eastern and North Western coastlines.
		DEM – District Emergency Organisations (DEOs) Interface	To conduct a series of training workshops aimed at building capacities within administrators across different community groups as demarcated by the national political constituencies
		Continued Sensitization and Updating of the National Volunteer Registry	To sensitize the public of the National Volunteer Registry and the role played during the hazardous events and disasters as it relates to community response.
		Community Plan Focus Exercise	<ul style="list-style-type: none"> <li>To orientate the volunteer arm of the DEM, DEOs and community leaders on the Barbados National Response Mechanism (BNRM) and how it relates to the district and community levels;</li> <li>To sensitize the volunteer arm of the DEM, DEOs and community leaders on the disaster planning and plan development processes;</li> <li>To discuss and introduce participants to the disaster planning framework and developing district disaster contingency plans and Standard Operating Procedures (SOP);</li> <li>To enhance the capacity of participants in the principles of testing disaster plans, the five (5) types of exercises and designing exercises to test plans and procedures</li> </ul>
		DEO Stalwart Recognition	To highlight the achievements and contributions of national volunteers in disaster resilience efforts. This activity is part of the DEM's commemoration of the UN Volunteer Day.
		The National "Give Back Programme"	To allow students of the UWI to volunteer at the department and be given "credit" for their participation. During the year the department was engaged by the COVID-19 Implementation Unit to assist with the Community Intervention with the Elderly, eight (8) students were given the opportunity to participate and gain credits. This was a community outreach administered to the elderly via telephone to gather information on their social and health situations. Members of the DEOs also participated in this activity.

Source: The Department of Emergency Management: Annual Reports (2020-2021)

<sup>257</sup> This will include strengthened community mitigation, preparedness and response, as well as the sustainment of community livelihoods through effective risk management. In addition, the programme is to strengthen the human resource capacity of DEM, emergency response personnel and community volunteers through targeted training and development programmes

Post-disaster, recovery, reconstruction and rehabilitation provide a unique opportunity for “building back better” so as to minimise the vulnerabilities that existed pre-disaster impact. Enhancing preparedness for effective response to “build back better” involves disaster preparedness plans, business continuity planning, strengthening early warning systems, critical infrastructure resilience, training and exercising, community planning, recovery and reconstruction policies as well as relief and donations policies.

However, Recovery and Planning for the post-disaster recovery process was identified as areas of significant weakness within Barbados’ National Emergency Management System during the 2018 CDM Audit. Yet, the performance of the Preparedness and Response phases was still stronger than that exhibited in the Mitigation and Recovery phases. While the Barbados CWP aims to address gaps, it must also ensure that the successes and achievements are sustained and further strengthened. In particular, the NEMS must (i) maintain the National Multi-Hazard Disaster Management Plan (NMHDMP) and emergency response mechanisms; (ii) increase training and exercises to test and enhance plans and improve CDM capabilities across the system; and (iii) promote disaster planning at the sectoral level.

There is an urgent need to enhance the national recovery framework, considering economic, social, environmental and infrastructural dimensions of recovery. Achieving this will not only facilitate a shared understanding and common integrated perspective on post-disaster recovery, but also promote ex-ante approaches that will maximize limited national resources. The Response phases of reporting encompassed four (4) themes<sup>258</sup>: Activation, Resources, Immediate Rehabilitation and Deactivation. Within the 2018 CDM Audit, there was no overall score for Response because of the existence of outstanding sub-elements within the area of Resources. Notwithstanding such, the overall score obtained for Response that is based upon the three remaining components was deemed as satisfactory. The scores observed for Activation as well as Immediate Rehabilitation and De-activation were higher than those obtained for Return to Normalcy (initial) - a subcomponent that is performing below the acceptable standard.

The Recovery phases of reporting encompassed three (3) themes: (i) Reconstruction and Repair of

Damaged Infrastructure; (ii) Macroeconomic and Budget Management; and the (iii) Revitalization for Affected Sectors. Overall, the 2018 CDM Audit revealed that Recovery was the weakest phase for Barbados - particularly within the Revitalization for Affected Sectors. Under the Revitalization for Affected Sectors, Business Continuity Planning acted as its sole sub-element and was later disaggregated into Government Continuity and Business Continuity. The only subsidiary standard that performed at a satisfactory level was the Government’s Continuity Plan when compared to the other subsidiary standards like the Government’s Contingency Continuity Plan, the Business Continuity Plan and the alignment of key sectors to support the Business Continuity Plan. This therefore emphasizes the need to prioritize business and government continuity to create an enabling environment to restore economic activity.

The Sendai Framework for Disaster Risk Reduction 2015-2030 advocates for shared ownership and partnerships to better address the socio-economic impacts of disasters. Similarly, Sustainable Development Goal 17 echoes the need for partnerships and stakeholder involvement. Partnerships enable access to resources, resource pooling, collaboration and joint action in support of disaster risk reduction and consequently, sustainable development. These are especially paramount to SIDS due to their resource limitations and high vulnerabilities. The private sector in Barbados can therefore support disaster risk reduction<sup>259</sup> by developing contingency plans, ensuring business continuity and improving disaster preparedness via new and improved public-private sector partnerships<sup>260</sup>. Through the Global Private Sector’s Alliance for Disaster Resilient Societies (ARISE) initiative<sup>261</sup>, the United Nations Office for Disaster Risk Reduction for the Americas and the Caribbean (UNDRR - ROAMC) promotes resilience strengthening by engaging various private sector actors and sub-regional organizations (UNDRR, 2019). The ARISE initiative seeks to facilitate proactive actions from the private sector to prevent economic loss and promote new business opportunities related to disaster management via<sup>262</sup>:

258 These components are represented by 17 key elements and a further 37 sub-elements.

259 BGIS. 2022. “Disaster Management Partnerships ‘Arise’ “. <https://gisbarbados.gov.bb/blog/disaster-management-partnerships-arise/>

260 BGIS. 2022. “Private Sector Partnerships Key To Boosting Production”. <https://gisbarbados.gov.bb/blog/private-sector-partnerships-key-to-boosting-production/>

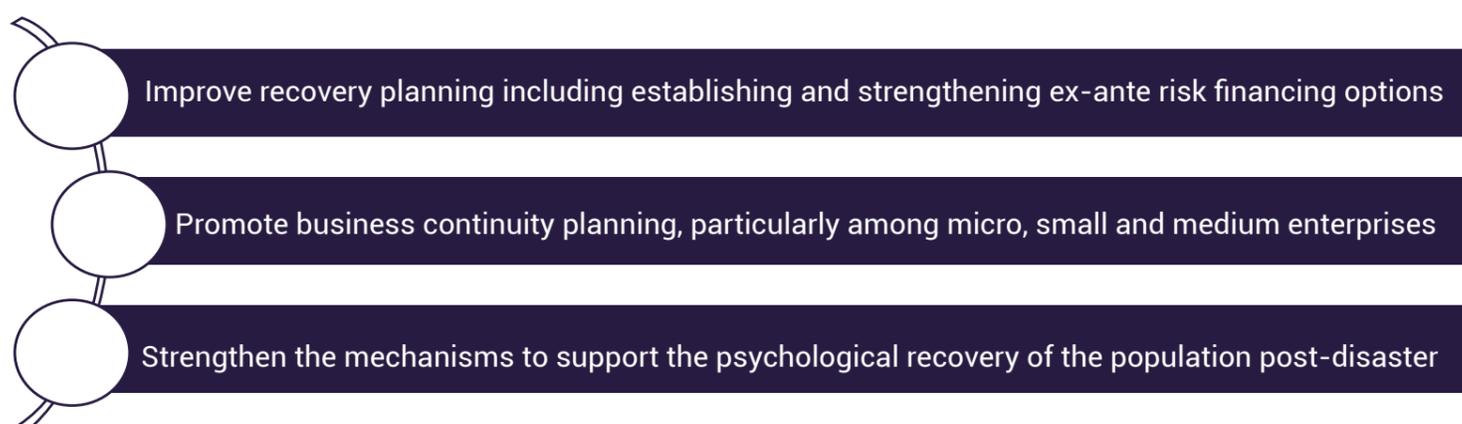
261 UNDRR. 2022. “ARISE Initiative”. <https://www.ariseglobalnetwork.org/>

262 UNDRR. 2022. “ROAMC Partnerships Annual Report: Private sector activities 2019”. <https://reliefweb.int/report/barbados/roamc-partnerships-annual-report-private-sector-activities-2019>

- Advocacy and raising interest among private sector actors,
- Continuing capacity building activities through Business Continuity Plans, Training of Trainers (ToTs) and development of DRR Action Plans workshops and
- Embedding ARISE principles in regional structures, such as with CARICHAM, IntegraRSE and the partnerships with Inter-Governmental Organizations.

Undoubtedly, the COVID-19 Pandemic has reinforced the call for business continuity planning at the level of state and the private sector. Overall, the 2018 CDM Audit highlighted the following recommendations (as seen in Figure 70) in support of national recovery efforts.

**Figure 70: CDM Audit Recommendations in support of National Recovery Efforts under Priority 4**



Source: Department of Emergency Management

Within its 2020 and 2021 Annual Reports, the DEM outlined a series of initiatives undertaken by the GoB to facilitate Recovery, Rehabilitation and Reconstruction efforts. Details regarding these initiatives can be seen in Table 21.

**Table 21: DRM Initiatives in Barbados to facilitate Recovery, Rehabilitation and Reconstruction**

Priority Area	Goal	Name of the Initiative	Overall Objective
Recovery	The goal of this programmatic area is to pursue programmes and activities that lead to an enhanced national recovery framework <sup>263</sup> .	Contingent Credit Facility for Natural Disaster (sic) Emergencies (CCF)	To spearhead the implementation and monitoring of three of the triggers/indicators agreed to in the Comprehensive Natural Disaster Risk Management Program (CNDRMP) (sic) via support from the Inter-American Development Bank.
		Recovery Operations for 2021 Emergency Events	To facilitate recovery actions were required in the aftermath of the significant ash fall event experienced in April 2021, the Freak Storm in June 2021, Hurricane Elsa in early July 2021 and the ongoing COVID-19 Pandemic. Such actions were largely focused on social protection and housing rehabilitation efforts post Freak Storm and Hurricane Elsa, clean-up campaigns post ash fall and post cyclone, and the revision of policies, plans and procedures to improve emergency management efforts going forward.

Source: The Department of Emergency Management: Annual Reports (2020-2021)

<sup>263</sup> The Recovery Framework seeks to achieve a shared understanding and a common, integrated perspective on Recovery in order to achieve unity of effort and make the most effective use of the country's limited resources. It considers and promotes social, environmental infrastructural and economic recovery. Focus is placed on the development and exercising of Continuity of Government Plans; development and application of model Business Continuity Plans; policy and procedures for accessing the Catastrophe Fund; as well as a strengthened Psychosocial Support Programme.

## 5.5 A Further Look Into Multi-Hazard Early Warning Systems

Effective early warning systems can drastically reduce loss and damage costs incurred from hazardous events. As defined by the United Nations Office for Disaster Risk Reduction (UNDRR)<sup>264</sup>, an Early Warning System is:

*"An integrated system of hazard monitoring, forecasting and prediction, disaster risk assessment, communication and preparedness activities systems and processes that enables individuals, communities, governments, businesses and others to take timely action to reduce disaster risks in advance of hazardous events".*  
(UNDRR, 2022)

At the 27<sup>th</sup> session of the Conference of the Parties of the UNFCCC (COP27) in Sharm el-Sheikh, Egypt, there were renewed efforts that emphasized the importance on early warning systems on the global scale via the adoption of an Executive Action Plan under the Early Warnings For All Action Initiative which seeks to equally support investments in adaptation and resilience<sup>265</sup>. Similarly, Target G of the Sendai Framework for Disaster Risk Reduction calls for a substantial increase in the availability of and access to Multi-Hazard Early Warning Systems (MHEWS) and disaster risk information and assessments to people by 2030<sup>266</sup>. MHEWS encompasses several hazards and/or impacts of similar or different type in contexts where hazardous events may occur alone, simultaneously, cascadingly or cumulatively over time, and taking into account the potential interrelated effect. Overall, effective MHEWS play a prominent role in disaster preparedness and climate change adaptation. Such systems not only embody data and technological machinery, but also include the several pillars<sup>267</sup> as defined by the World Meteorological Organization (WMO, 2018; WMO, 2022). As seen in Figure 71, these pillars

include: (i) Disaster Risk Knowledge; (ii) Detection, Monitoring, Analysis & Forecasting of Hazards and Possible Consequences (iii) Warning Dissemination and Communication; and (iv) Preparedness and Response Capabilities.

Small Island Developing States within the Caribbean region are at the forefront of making rapid progress<sup>268</sup> in the planning and development of Multi-Hazard Early Warning Systems<sup>269</sup>. Such initiatives will factor in a multitude of "experiences in recent years that have inevitably strengthened planning and coordination to deal with hazards, whatever their origin, magnitude or concatenation,"(UNDRR, 2022).

264 UNDRR. 2022. "Terminology: Early Warning Systems". <https://www.undrr.org/terminology/early-warning-system#:~:text=Annotations%3A%20Effective%20%E2%80%99>

265 WMO. 2022. "Early Warnings for All Action Plan unveiled at COP27". <https://public.wmo.int/en/media/press-release/early-warnings-all-action-plan-unveiled-cop27>

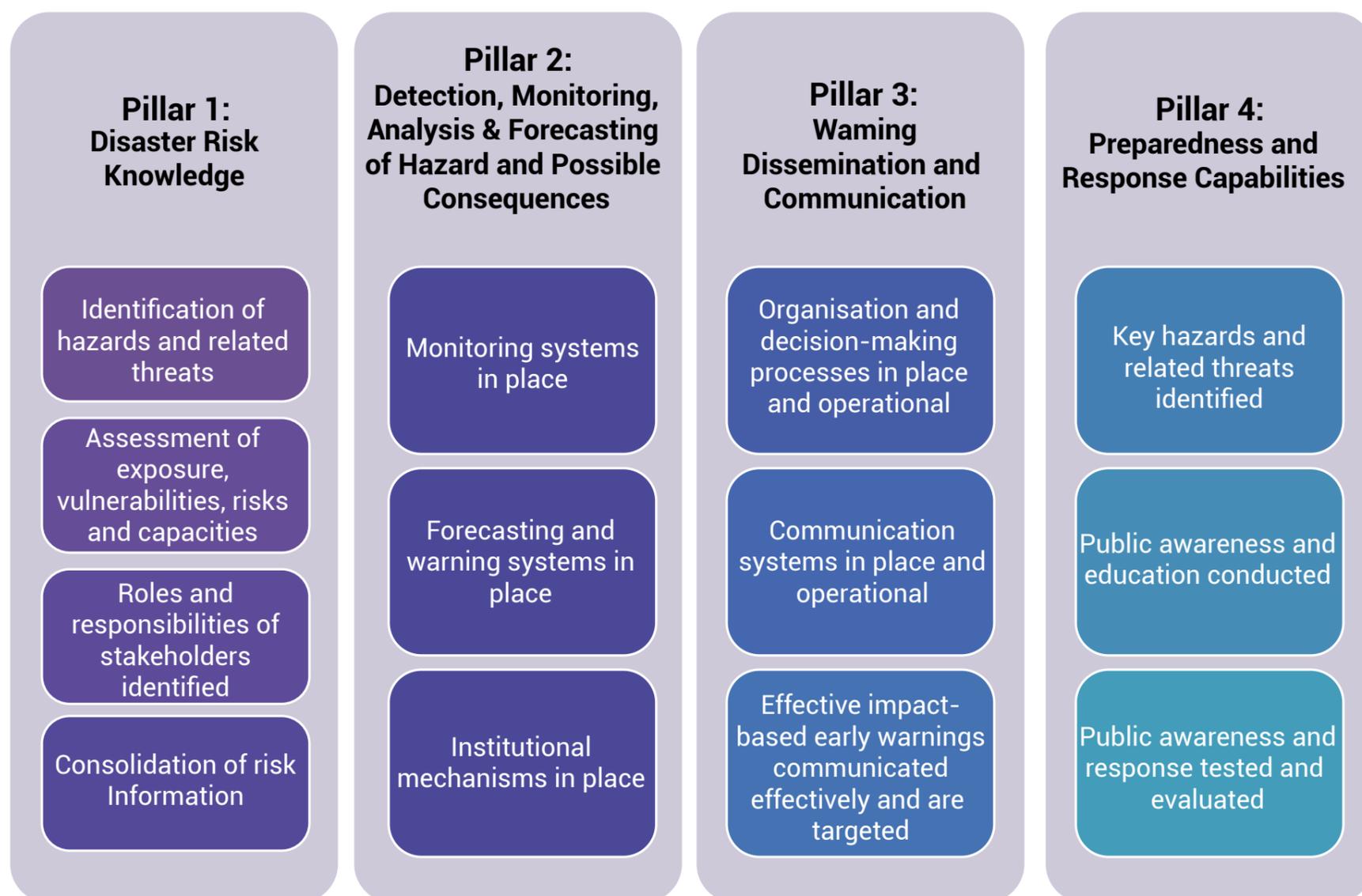
266 UNISDR. 2014. Sendai Framework for Disaster Risk Reduction (2015-2030)

267 WMO, UNISDR and UNESCO. 2018. "Multi-Hazard Early Warning Systems: A Checklist. International Network for Multi-Hazard Early Warning Systems". In the Barbadian context, these four (4) pillars are further disaggregated into 13 measures which are associated with 131 items.

268 UNDRR. 2022. "The Caribbean consolidates its partnership for advancing Multi-Hazard Early Warning Systems in the region". <https://www.undrr.org/news/caribbean-consolidates-its-partnership-advancing-multi-hazard-early-warning-systems-region>

269 UNDRR. 2022. "The Caribbean is at the forefront of Early Warning Systems". <https://www.undrr.org/news/caribbean-forefront-early-warning-systems>.

**Figure 71: Pillars of an Effective Multi-Hazard Early Warning System**



Source: The Multi-Hazard Early Warning Systems Roadmap and Action Plan: Barbados (2021-2024)

To underscore its commitment to disaster resilience efforts on the national and local scales, the GoB has embarked upon an initiative: The Barbados Multi-Hazard Early Warning System (MHEWS) Roadmap and Action Plan (2021- 2024)<sup>270</sup>. This national instrument is aligned with the island's CDM strategic objective to significantly reduce impacts on the society, the economy as well as vulnerable and disadvantaged groups. It is therefore aligned with the island's Comprehensive Disaster Management (CDM) Country Work Programme (CWP) (2019-2023)<sup>271</sup> which acts as a three-year guide for advancing a multi-hazard early warning agenda in Barbados. The National MHEWS Roadmap and Action Plan (2021 - 2024) is intended:

"To guide national local actions and investments towards improving the island's Early Warning

Systems (EWS) for more effective disaster risk reduction (DRR) and to move towards the realisation of a more integrated system based on the findings of the MHEWS Gap Analysis Report for Barbados." (CDEMA/World Bank, 2022)

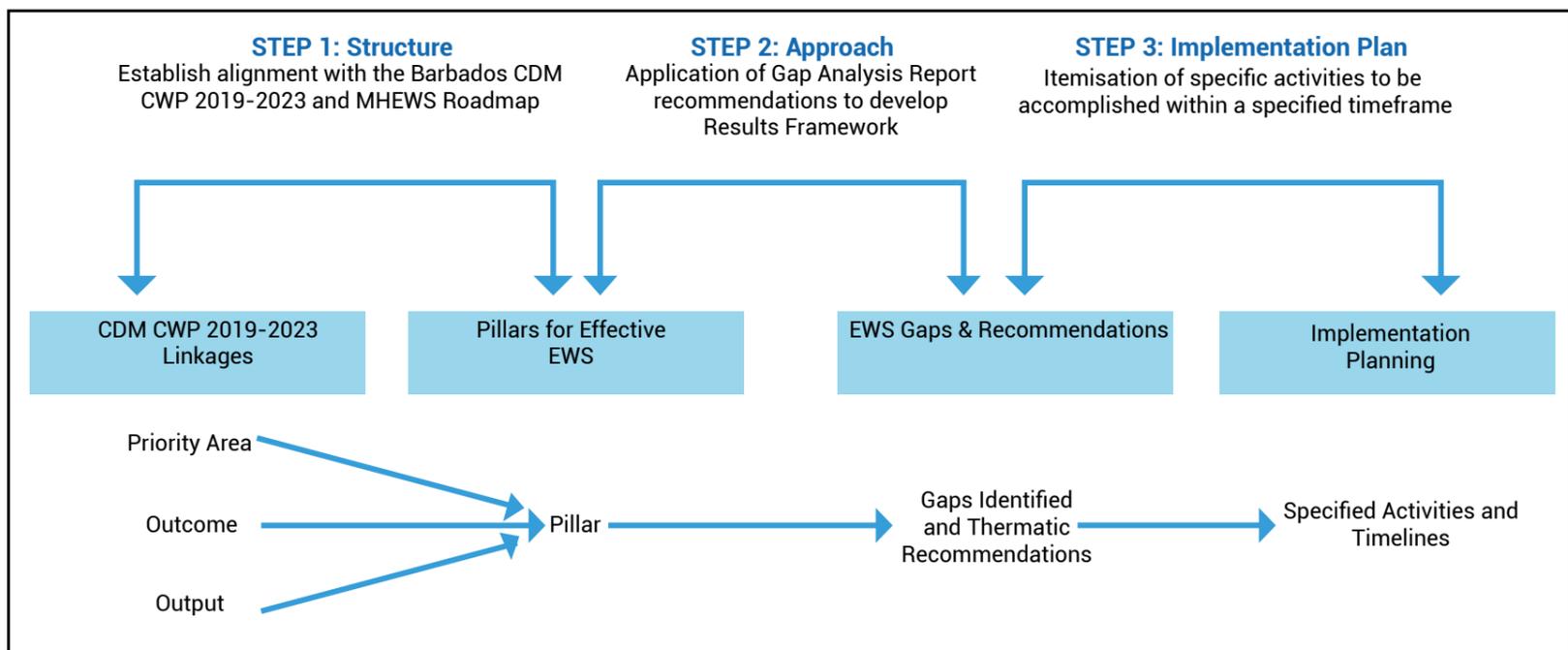
The Barbados MHEWS Roadmap and Action Plan (2021- 2024) can be disaggregated into three (3) main steps which seek to: (i) demonstrate the layout and structure of the proposed plan; (ii) factor in recommendations of the MHEWS Gap Analysis Report for Barbados<sup>272</sup> in an effort to derive the most suitable national approach; and (iii) facilitate the implementation of the Barbados MHEWS Roadmap and Action Plan (2021 - 2024) by prioritizing specific activities to promote the desired outcomes. A depiction of the Barbados MHEWS Roadmap can be seen in Figure 72.

270 CDEMA, DEM, 2021. "The Multi-Hazard Early Warning Systems Roadmap and Action Plan: Barbados (2021-2024)".

271 DEM 2019a

272 CDEMA. 2022. 'The CDEMA/DEM Multi-Hazard Early Warning Systems – Gap Analysis Report: Barbados'

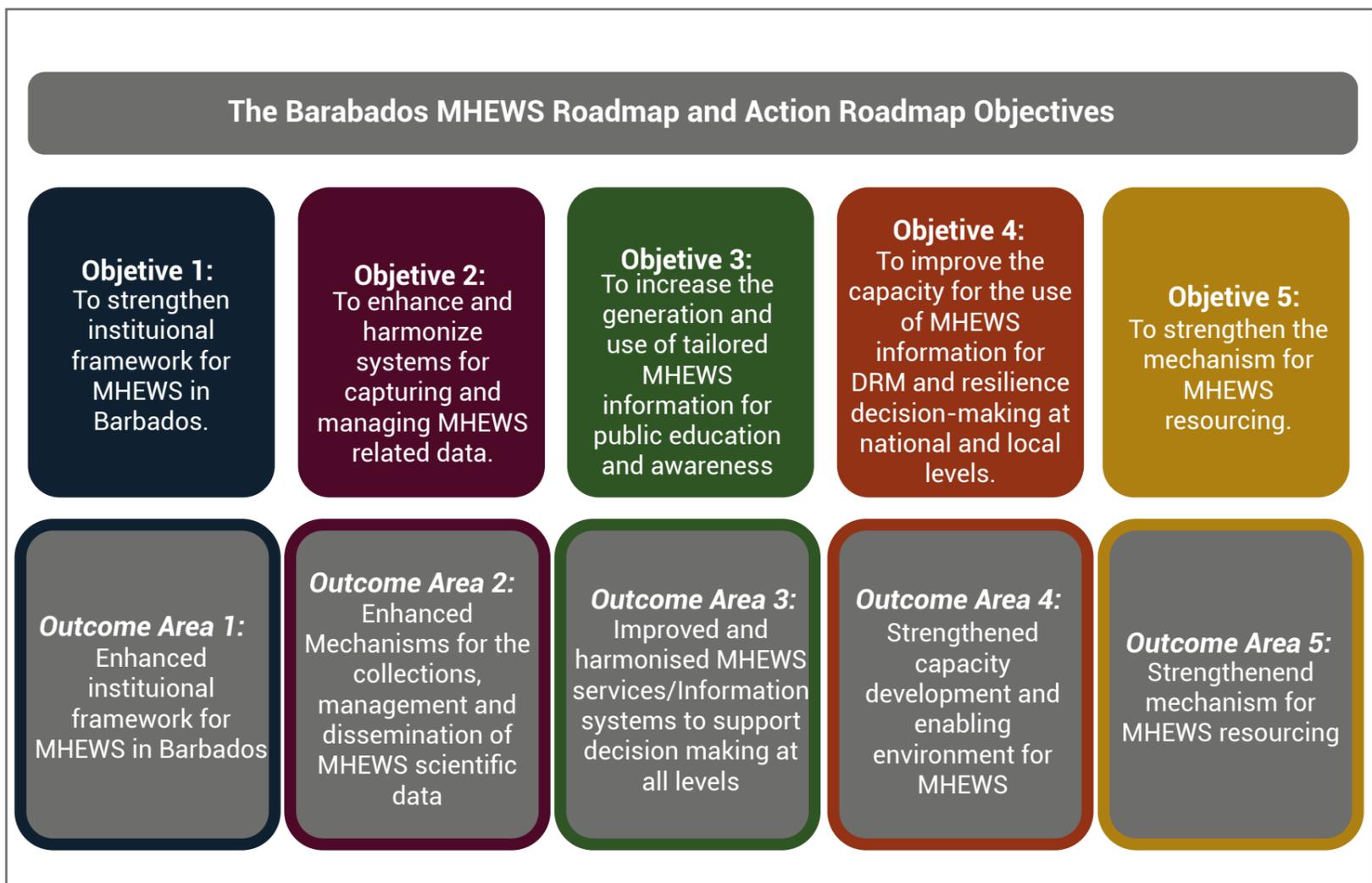
**Figure 72: Construction of the Barbados MHEWS Roadmap**



Source: The Multi-Hazard Early Warning Systems Roadmap and Action Plan: Barbados (2021-2024)

The ultimate goal of the Barbados MHEWS Roadmap and Action Plan (2021- 2024) is to build a national integrated MHEWS that is science-informed, evidence-based and supports decision making of all stakeholders. The national instrument seeks to improve systems and service for understanding, communicating, warning and preparing for the priority hazards in Barbados. Objectives under the national MHEWS Roadmap and Action Plan (2021- 2024) can be seen in Figure 73.

**Figure 73: Objectives under the Barbados MHEWS Roadmap and Action Plan (2021 - 2024)**



Source: The Multi-Hazard Early Warning Systems Roadmap and Action Plan: Barbados (2021-2024)

Ultimately, it is intended that organisations across Barbados will integrate the MHEWS Plan into their agencies' programming<sup>273</sup> to facilitate the optimal use of resources across national and local levels.

The MHEWS Gap Analysis Report for Barbados was validated and endorsed by national stakeholders. The report presented five (5) thematic recommendations across all MHEWS pillars (as seen in Figure 71) in an effort to improve the efficiency and effectiveness of the national MHEWS and hence its alignment with the island's CDM CWP over the period 2019-2023. As depicted in Tables 38-42 of Appendix XI, these thematic recommendations include:

- **Thematic Recommendation for Roadmap Outcome 1:** The Enhancement of the MHEWS Policy that is informed by CDM principles and processes which ensures that the design, operation, management, monitoring, and evaluation of EWS in Barbados is developed and implemented.
- **Thematic Recommendation for Roadmap Outcome 2:** Improvements in MHEWS Data Management Systems for better Data Capture and Storage via a user-friendly platform that employs a balance of scientific and technological approaches with indigenous knowledge to capture data and disseminate accurate warnings.
- **Thematic Recommendation for Roadmap Outcome 3:** Improvements in Public Awareness, communications; and understanding of the MHEWS among communities to enhance readiness and response capabilities to reduce disaster risk.
- **Thematic Recommendation for Roadmap Outcome 4:** Capacity Development to ensure the MHEWS is supported by defined competency standards for EWS professionals and volunteers as well as a Comprehensive Capacity Development Programme.
- **Thematic Recommendation for Roadmap Outcome 5:** Adequate MHEWS resourcing derived from human and financial resources at the national and local levels allocated

to support a MHEWS underpinned by evidence-based reporting and capacity development.

The MHEWS Status for Barbados can be observed in Table 22. This status considers the four components of early warning systems whilst utilising the UNDRR's Hazard Taxonomy groupings. It is evident that early warning systems for hydrometeorological, environmental, biological and chemical hazards are more advanced than existing capacities for geological, technological and societal hazards. This emphasizes an overall need to strengthen the MHEWS mechanism for the country.

<sup>273</sup> This includes activities that have been either coordinated and or supported by the respective agencies.

<b>GEOLOGICAL HAZARDS</b>	<b>HYDRO METEOROLOGICAL HAZARDS</b>	<b>ENVIRONMENTAL HAZARDS</b>	<b>BIOLOGICAL HAZARDS</b>	<b>CHEMICAL HAZARDS</b>	<b>TECHNOLOGICAL HAZARDS</b>	<b>SOCIETAL HAZARDS</b>
1. Earthquake	1. Tropical Cyclone/ Tornado	1. Deforestation	1. Human Epidemics & Pandemics	1. Oil Pollution	1. Boat/Road / Air crash / Accidents	1. Civil Unrest
2. Tsunami	2. Flood	2. Land & Soil Degradation	2. Animal Epidemics & Pandemics	2. Persistent Organic Pollutants	2. Infrastructural Failures	2. Violence
3. Volcanic Eruption	3. Storm Surge	3. Biodiversity	3. Pest Infestation		3. Fires	3. Financial Shock
4. Landslide	4. Drought	4. Environmental Pollution	4. Invasive Species		4. Explosions	
	5. Cloudburst	5. Wildfires			5. Spills & Leaks	
	6. Landslide					
	7. Heat & Cold Wave					

<b>Colour</b>	<b>EWS Components Represented</b>	<b>Colour</b>	<b>EWS Components Represented</b>
	C1 - Disaster Risk Knowledge		C2-Hazard Detection, Monitoring and Forecasting C3- Warning Dissemination and Communication
	C2-Hazard Detection, Monitoring and Forecasting		C1-Disaster Risk Knowledge C3- Warning Dissemination & Communication C4- Preparedness for response to warnings
	C3- Warning dissemination & Communication		

## The Early Warning for All Initiative – An opportunity to implement the Roadmap

The Early Warnings for All (EW4All) is a special initiative of the UN Secretary General, which aims to spearheading action to ensure every person on Earth is protected by early warning systems by 2027.

The Early Warnings for All initiative was formally launched by the UN Secretary-General in November 2022 at the COP27 meeting in Sharm El-Sheikh. The Initiative calls for the whole world to be covered by early warning systems by the end of 2027. EW4All is co-led by WMO (World Meteorological Organization) and UNDRR and supported by pillar leads ITU (International Telecommunication Union) and IFRC (International Federation of Red Cross and Red Crescent Societies). Additional implementing partners include FAO (Food and Agriculture Organization), GEO (Group of Earth Observation) Secretariat, IOM (International Organization for Migration), OCHA (United Nations Office for the Coordination of Humanitarian Affairs), UNDP (United Nations Development Programme), UNEP (United Nations Environment Programme), UNESCO (United Nations Educational, Scientific and Cultural Organization), UNICEF (United Nations Children's Fund), REAP (Risk-informed Early Action Partnership), WFP (World Food Programme) and others.

EW4All aims to promote collaboration and synergies across all partners working on the promotion, design, implementation, development and monitoring of single, cluster and multi-hazard early warning systems.

The Implementation Plan for the Initiative outlines the initial actions required to achieve universal coverage of multi-hazard early warning systems within five years, and sets out the pathway to implementation.

The implementation process should be guided by the stakeholder coordination mechanism established or confirmed in the national consultative workshop. Each EW4All Pillar has developed a detailed 18-month workplan and a 5-year implementation strategy, which should be consulted and used as guidance and blueprint. A key focus of this initiative is to promote a coordinated, cross pillar approach that prioritizes strong coordination. A monitoring framework has been established for use in countries, and technical support is also available to strengthen reporting on Target G of the Sendai Framework, which tracks progress on Early Warning systems.

# Stakeholder Analysis

## Chapter 6 Overview

This chapter acknowledges the concerted actions of a diverse range of stakeholders in facilitating disaster risk reduction efforts in accordance with the Sendai Framework on Disaster Risk Reduction and the Sustainable Development Goal 17: Partnerships for the Goal.

### 6. Stakeholder Analysis

The Sendai Framework for Disaster Risk Reduction advocates for shared ownership and partnerships. Similarly, Sustainable Development Goal 17 echoes the need for partnerships and stakeholder involvement. Partnerships enable access to resources, resource pooling, collaboration and joint action in support of disaster risk reduction and consequently, sustainable development. These are especially paramount to SIDS due to their resource limitations and high vulnerabilities. To support this stance, several meaningful efforts to strengthen partnerships and cooperation have been instituted in Barbados over the years. As a result, the Disaster Risk Reduction Agenda for Barbados has benefited from a wide range of local, national, regional and international partnerships and continues to show an exceptional level of promise in its level of stakeholder engagement.

At the local level, community involvement is evident via the existence of District Emergency Organizations (DEOs) across the thirty (30) parliamentary constituencies. DEOs are chaired by thirty (30) personnel and currently maintains a volunteer registry of 942 individuals across all parliamentary constituencies<sup>274</sup>. Collectively, they conduct numerous activities to strengthen resilience - particularly within vulnerable groups such as women, children, the elderly and the disabled community.

<sup>274</sup> DEM. 2021.

At the national level, there is a greater effort by ministries and departments to include private sector and civil society in activities via consultations and capacity building exercises. For instance, the DEM conducts annual activities<sup>275</sup> during March, April and June that are primarily based on preparedness, education and advocacy. Such activities increase the awareness of disaster risk amongst stakeholders at all levels thereby promoting preparedness action. There are also sixteen (16) EMAC Standing Committees with its distinct roles and responsibilities within the National Emergency Management system<sup>276</sup> (Appendix III) – this includes representation within the private sector and civil society. Similarly, the Disaster Social Relief Committee (DSRC)<sup>277</sup> acts as the operational arm of the Disaster Social Relief Plan (DSRP).

The private sector has been instrumental in providing support for national development efforts.

<sup>275</sup> These annual activities include Coastal Hazards and Earthquake Month in March; Volcanic Hazards Awareness Week during the second week in April; and Hurricane Awareness Month in June.

<sup>276</sup> The Standing Committees of the Emergency Management Advisory Council (EMAC) are generally organized along the Emergency Support or Response Functions or sector response: Emergency Services; Public Information & Education; Damage Assessment and Needs Analysis; Health Services – Medical & Public Health; Food & General Supplies; Public Utilities; Emergency Transport; Shelter Management; Disaster Social Relief; Road Clearance & Tree Trimming; Telecommunications; Housing and Rehabilitation; National Hazard Mitigation; Tourism Emergency Management; Technical Standing Committee on Coastal Hazards; and Oil Spill Committee.

<sup>277</sup> This committee falls under the auspices of the Ministry of People Empowerment and Elder Affairs (MPEA).

Cognisant of the important role of the private sector, public-private partnerships on the national front have been maintained to facilitate initiatives in economic development, tourism, education and healthcare – particularly against the spread of the COVID-19 pandemic. With support from the Ministry of Home Affairs and Information, strategic meetings are regularly held with the private sector to foster their support in response and recovery operations. Telecommunications service providers within the private sector are also crucial to the early warning mechanism thereby rendering support to the national alerting system.

Civil society renders support to response operations by providing emergency telecommunications and surveillance support via drones and other operations. Such entities include the Barbados Citizens Band Association (BCBRA); the Amateur Radio Society of Barbados (ARSB); and the Barbados Red Cross Society (BRCS). Media coverage has also been critical to the national disaster management mechanism, as a core stakeholder in the communication strategy, facilitating education and advocacy as well as crisis and emergency communications. Academic institutions like the University of the West Indies – Cave Hill Campus in Barbados support research and knowledge building efforts. Charitable non-profit organisations have been instrumental in providing logistical support during emergencies and disasters via formalized arrangements. For instance, auxiliary bodies like the Roving Response Team (RRT) often lend support to emergency efforts.

Barbados' partnerships with regional and international agencies are very significant. Such partnerships have allowed the country to leverage technical and financial resources for disaster risk reduction initiatives. At the regional level, this involves collaborations with entities like the Pan-American Health Organization (PAHO); the Caribbean Disaster Emergency Management Agency (CDEMA); the Caribbean Community (CARICOM); the Caribbean Public Health Agency (CARPHA); the Caribbean Community Climate Change Centre (CCCCC); the Caribbean Development Bank (CDB); the Latin American Development Bank (CAF); the Inter-American Development Bank (IDB); the Network of Caribbean Chambers of Commerce (CARICHAM); the United Nations Subregional Office for Barbados and the Organization of Eastern Caribbean States (UNDP: Barbados & the OECS); the United Nations Children's Fund (UNICEF); the United Nations Economic Commission for Latin America and the Caribbean (UNECLAC); the Organization of Eastern

Caribbean States (OECS), the University of the West Indies (UWI); the Caribbean Institute for Meteorology and Hydrology (CIMH) and the Caribbean Tsunami Information Centre (CTIC).

Multinational and international partners continue to grow to render support for DRR efforts - and in many instances this support has increased significantly. Such partners include the World Bank, the World Meteorological Organization (WMO), various entities within the United Nations System<sup>278</sup> and the Global Private Sector's Alliance for Disaster Resilient Societies (ARISE) initiative<sup>279</sup>. Since independence, Barbados has nurtured bilateral ties with the United Kingdom, the United States of America, Canada, Japan and China. Since the attainment of its republican status, Barbados has forged several bilateral relationships across Europe, Sub-Saharan Africa, the Middle East and Latin America.

278 For example, the United Nations Environment Programme; the United Nations Development Programme; the United Nations Educational, Scientific and Cultural Organization; the United Nations Office for the Coordination of Humanitarian Affairs; and the United Nations Office of the High Representative for the Least Developed Countries, Landlocked Developing Countries and Small Island Developing States).

279 UNDRR. 2022. "ARISE Initiative". <https://www.ariseglobalnetwork.org/>

# Impacts and Barbados' Institutional Response to the Covid-19 Pandemic

## Chapter 7 Overview

This chapter provides a synopsis of Barbados' institutional response to the COVID-19 Pandemic and its associated impacts on the standard of living and level of commerce. It lauds the achievements made by the Government of Barbados to ensure citizen security. This was achieved via the institution of national protocols and vaccination procedures. In addition to this, the Government of Barbados rendered support to neighbouring CARICOM Member States in their concerted efforts to address the risk posed; and facilitated donor engagements at the bilateral, regional and international levels.

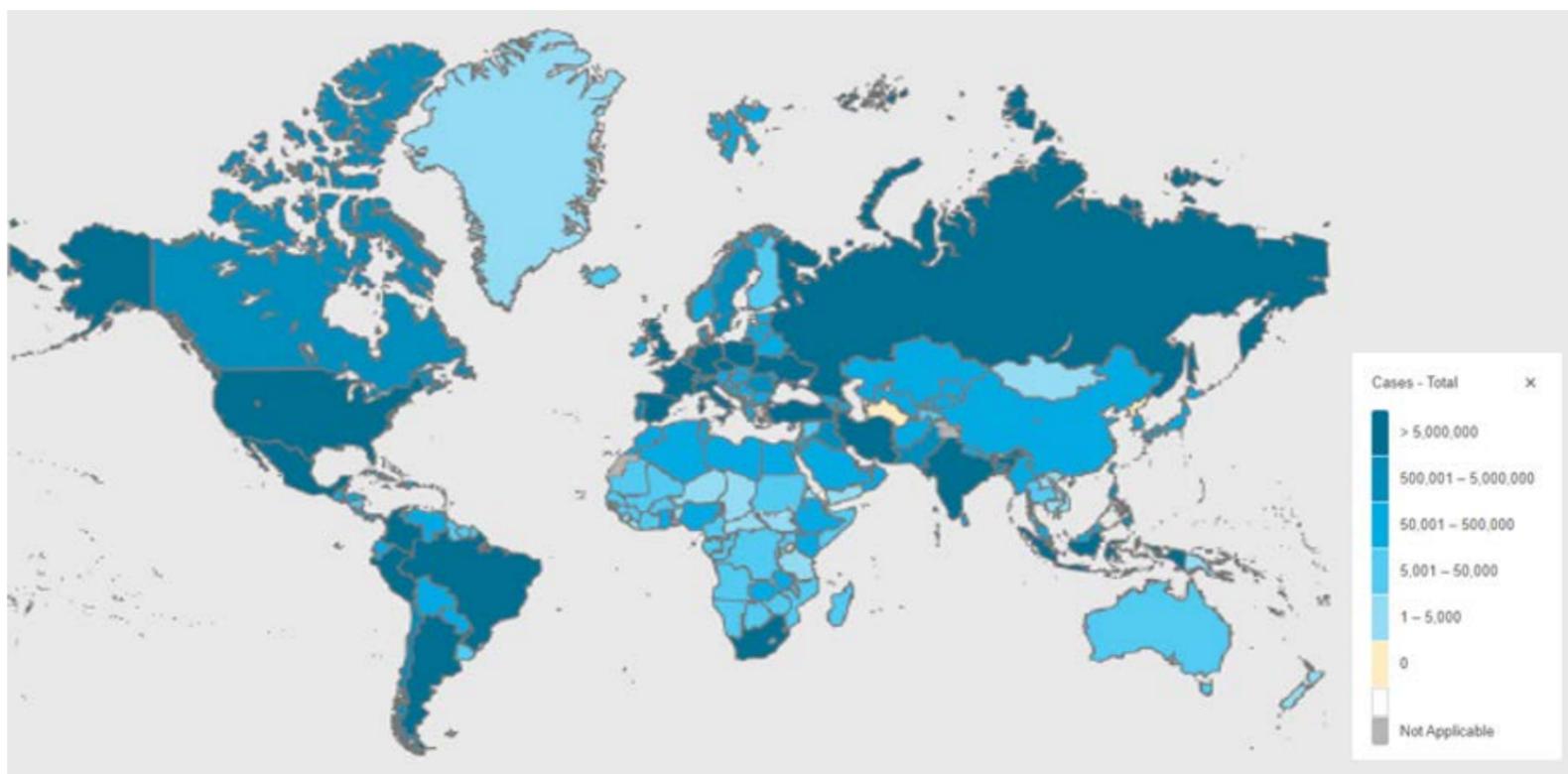
## 7. Impacts and Institutional Response to Covid-19

The timing of this UNDRR study coincides with one of the world's most challenging threats to modern-day life - the COVID-19 Pandemic. On March 11, 2020, COVID-19 was declared as a 'pandemic' by the World Health Organization. However, during his 2nd of March, 2020 multimedia address at the WHO Headquarters in Geneva, the WHO Director-General noted that:

*"This epidemic can be pushed back but only with a coordinated and comprehensive approach that engages the entire machinery of government. We're calling on every country to act with speed, scale and clear-minded determination."*

*(WHO Director-General Dr. Tedros Adhanom Ghebreyesus, March 2020)*

**Figure 74: Geographical distribution of reported COVID-19 cases as of 24 November 2022**

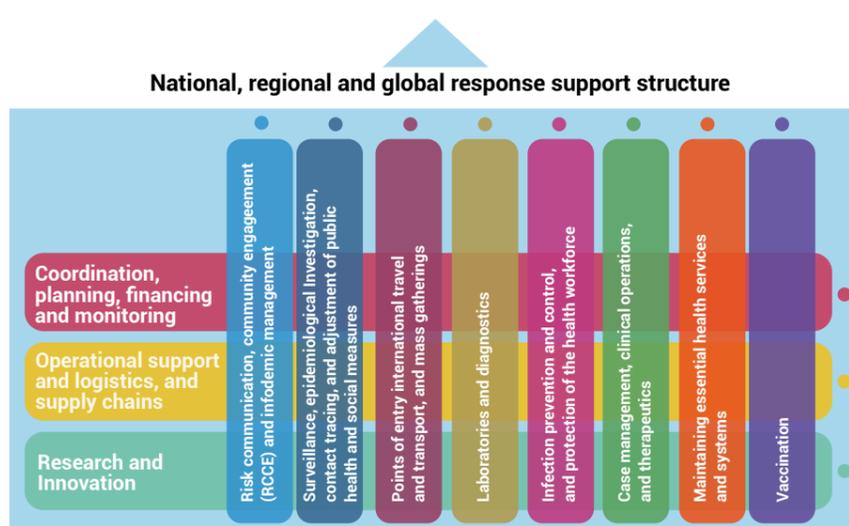
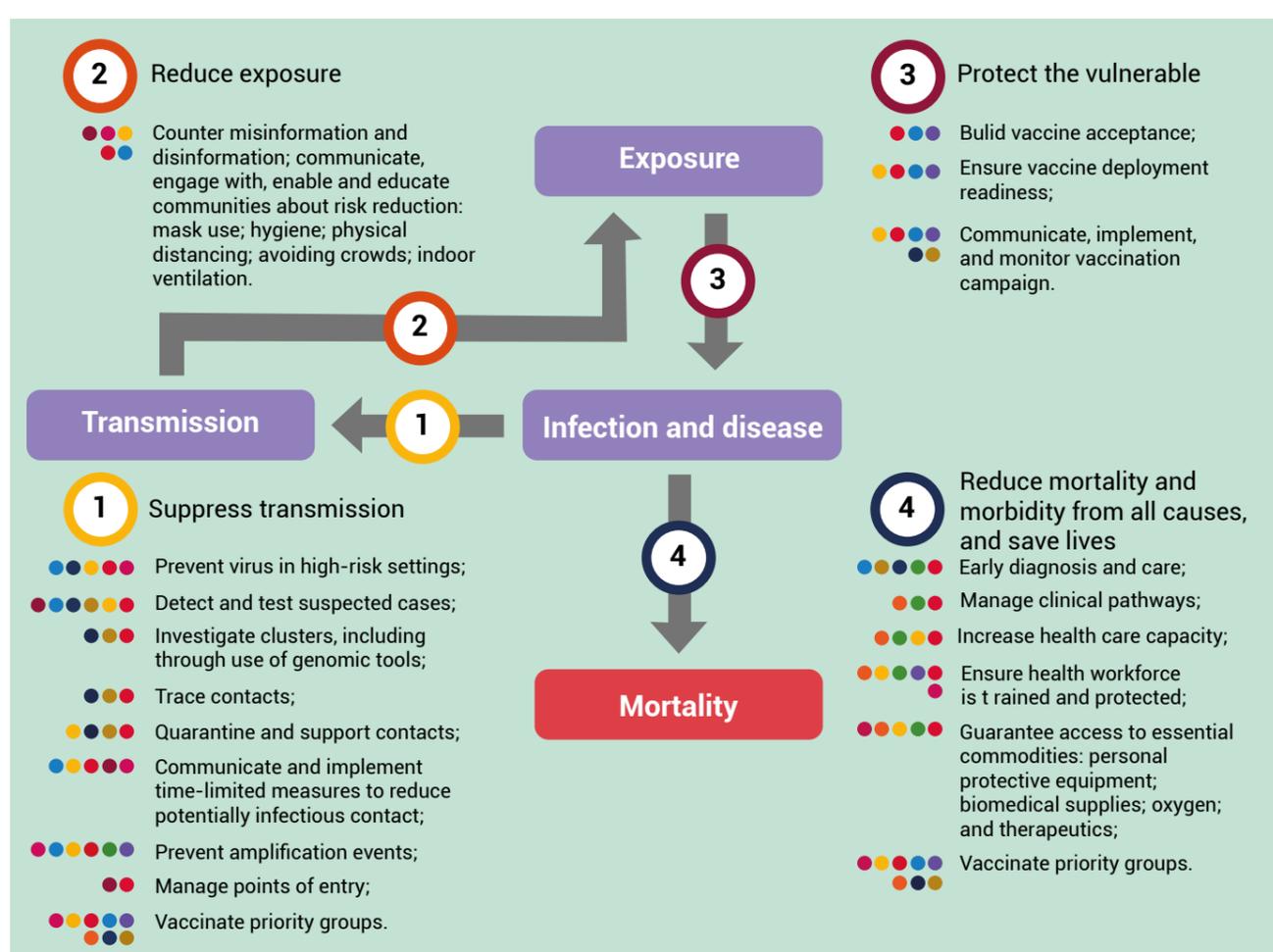


Source: WHO, 2021

Note: Globally, as of 6:38pm CET, 24 November 2022, there have been 636,089,587 confirmed cases of COVID-19, including 6,604,704 deaths, reported to WHO. As of 16 November 2022, a total of 12,943,741,540 vaccine doses have been administered.

Noting the myriad of challenges facing Barbados and the wider Caribbean region, developmental and technical assistance was sought at the regional and international levels. The Pan-American Health Organization (PAHO) is a United Nations entity responsible for ensuring the health and quality of life for people living in the Americas. Thematic areas covered by the PAHO include: (i) Communicable Diseases and Environmental Determinants of Health; (ii) Evidence and Intelligence for Action in Health; (iii) Family, Health Promotion and Life Course; (iv) Gender, Equity, and Cultural Diversity; (v) Health Emergencies; (vi) Health Systems and Services; and (vii) Noncommunicable Diseases and Mental Health. The PAHO Office for Barbados and the Eastern Caribbean is located in Barbados. On January 30th, 2020, PAHO activated its Incidence Management Team<sup>280</sup> and embarked upon its COVID-19 Strategic Preparedness and Response Plan (SPRP). The primary goal of the PAHO's Incidence Management Team was to build resilience and readiness for the future through the achievement of strategic objectives as envisioned within the SPRP. This would allow PAHO to save lives, protect health care workers and halt the spread of the COVID-19 Coronavirus<sup>281</sup> by intervening in an effort to break the cycle of transmission-exposure infection-transmission/mortality.

**Figure 75: Public Health and Social Measures are supported by multiple response pillars**



To achieve our collective strategic objectives we must intervene to break the cycle of transmission-exposures-infection-transmission/mortality. The key interventions and capacities to weaken and break each of the links in this chain are shown above under headings 1-4. The precise nature and form that these public health and social measures take will and should differ between countries, and between subnational areas within countries, according to context and capacities. However, all of these interventions and capacities must be underpinned and facilitated by a multidisciplinary national and/or subnational response structure. The success of every intervention is supported and enabled by multiple pillars of the response. These national response structures are supported in turn by global operational and technical support platforms, including a cross-cutting research and innovation pillar at the global and regional level.

Source: WHO, 2021

280 This consisted of PAHO experts in the following fields and technical areas: surveillance, health services, laboratory testing, clinical management, infection prevention and control.

281 For the purposes of national level planning and coordination, the high-level COVID-19 SPRP 2021 retains the same core structure and rationale as the SPRP for 2020 with a number of key additions and adaptations in response to lessons learned over the past 12 months, and to address new challenges in the year ahead.

The PAHO sought to assist and to buttress the response mechanisms across the Barbados and the Eastern Caribbean<sup>282</sup> via the following strategic objectives and measures:

**Figure 76: PAHO Strategic Objectives**



Source: WHO, 2021

282 This grouping includes Antigua and Barbuda, Dominica, Grenada, St. Lucia, St. Kitts & Nevis as well as St. Vincent and the Grenadines.

**Figure 77: Pillars of the National-level Preparedness and Response**



Source: WHO, 2021

Barbados recorded its first two confirmed cases of COVID-19 on March 17<sup>th</sup>, 2020 – both imported cases from the United States of America. In light of such, the country embarked on a quick, highly coordinated and comprehensive response during March 2020 to avert future risks<sup>283</sup>. The nature of this response as well as the presence of legislation coordinating bodies and facilities to address national crises<sup>284</sup> are undoubtedly key factors in the country's success to date in preventing widespread community transmission (PAHO/WHO, 2020; DEM, 2017).

Such legislation<sup>285</sup> refers to the 2007 Emergency Management Act, Cap 160A, the National Shutdown Policy and the National Reactivation Policy. The 2007 Emergency Management Act, Cap 160A provides legislative authority for the mainstreaming of Comprehensive Disaster Management and designates responsibility to the Emergency Management Advisory Council for recommending policies, programmes and activities to enhance the emergency management programme; management of sixteen (16) Standing Committees

283 Pan-American Health Organization. 2021. "Barbados – An example of government leadership and regional cooperation in containing the COVID-19 virus". <https://www.paho.org/en/documents/barbados-example-government-leadership-and-regional-cooperation-containing-covid-19-virus>

284 DEM. 2019; DEM. 2017

285 As seen in Table 10 which provides a synopsis of Overarching Disaster Management Policies in Barbados.

responsible for advancing detailed sectoral disaster management planning, and thirty (30) voluntary District Emergency Organizations through which the community disaster management programme is facilitated. The National Shutdown Policy is used to issue a National Shutdown Administrative directive from the Director of the DEM on behalf of the GoB in light of a hazardous event. The National Reactivation Policy is used to issue a National Reactivation Directive from the Director of the DEM on behalf of the GoB after the occurrence of a hazardous event. This occurs in two (2) phases after the 'All Clear' has been given: (i) Emergency services, security forces and frontline/first responders and; (ii) the general public. This instruction was issued to the emergency services, security forces and frontline/first responders who are part of the Emergency Telecommunications System<sup>286</sup>.

The coordination of the National Emergency Response to the pandemic was achieved via the National Emergency Management Systems (NEMS) – an overarching mechanism to address emergency management on the island. This NEMS is later disaggregated into the Emergency Management Advisory Council, the Emergency Operations Centre /Emergency Management Teams, sixteen (16) Emergency Management Standing Committees and thirty (30) District Emergency Organisations (DEOs). Barbados has already established a National Emergency Operations Centre (NEOC) – a centralised location from which the mobilisation and coordination of responses and resources is carried out in the event of a major incident, emergency or disaster. The operations provide 24-hour service<sup>287</sup>.

The measures employed by the GoB included the sensitization of the public<sup>288</sup> to the threat posed by the COVID-19 Coronavirus via various modes of media<sup>289</sup> and the establishment of national restrictions to enable early prevention of the viral

transmission. Such restrictions included social distancing; the suspension of non-essential services; the issuance of travel protocols; national alphabetized supermarket systems and shopping schedules for supermarkets, fish markets, hardware stores and banking institutions<sup>290</sup>; virtual classes for primary, secondary and tertiary students; work-from-home modalities and the implementation of a national curfew<sup>291</sup>.

The GoB issued a State of Emergency on March 28<sup>th</sup>, 2020. Following such, a series of national curfew directives<sup>292</sup> was issued by the DEM under the auspices of the Ministry of Home Affairs and Information. Similarly, 24-hour national telephone hotlines<sup>293</sup> were established by the Ministry of Health and Wellness to provide several different functions thereby ensuring the safety of all Barbadians and visitors on the island.

To promote the scaling up of national activities in efforts to minimize, treat and prevent the spread of COVID-19, the following measures were employed. During March 2020, a former naval base at Harrison Point, within the most northly parish on the island – Saint Lucy, was earmarked to be redeveloped into a quarantine facility<sup>294</sup>. Originally, this facility acted as the Harrison Point Naval Base during colonial times and was later refurbished to abate the potential numbers of COVID-19 patients and to limit the direct strain posed to medical facilities and personnel at the sole public hospital on the island – The Queen Elizabeth Hospital<sup>295</sup>. The northern based COVID-19 facility was designated for severe cases and could accommodate between 150 to 160 persons (BGIS, 2020). To complement the national quota of medical staff and to strengthen bilateral

286 Agencies include the Royal Barbados Police Force, the Barbados Fire Service, the Ministry of Public Works, the Barbados Defence Force, the Barbados Light and Power Company, the Grantley Adams International Airport, the Barbados Port Inc. and the island's main Telecommunication providers: Digicel and FLOW.

287 DEM. 2017

288 The Barbados Government Information Service (BGIS) is the official communications arm of the Government of Barbados. It was designated as the primary source of accurate information on COVID the day after the first case was reported. The website contains a range of protocols, situation reports and articles, and educational videos. <https://gisbarbados.gov.bb/covid-19/>

289 This includes print media (COVID-19 updates and infographics), social media campaigns and television and radio announcements and transmissions from various entities under the auspices of the Ministry of Home Affairs and Public Information – particularly (The Barbados Government Information Service (BGIS) and the Department of Emergency Management (DEM) as well as other entities that fall under the umbrella of the National Emergency Management Systems (NEMS).

290 BGIS 2019. "Shopping Schedule during COVID -19 Curfew". <https://gisbarbados.gov.bb/blog/shopping-schedule-during-covid-19-curfew/>

291 Initially, the National curfew was from 8:00 p.m. to 5:00 a.m. and was extended after a period of 30 days. <https://gisbarbados.gov.bb/blog/attorney-general-explains-state-of-emergency-extension/>. The curfew was later relaxed to 12:00 a.m. to 5:00 a.m. in late 2021.

292 BGIS. 2019. "National Protocols". <https://gisbarbados.gov.bb/covid-19-protocols/>

293 This 24-hour hotline manned by medical and nursing students and volunteers to provide accurate information to individuals—in an effort to counter rampant misinformation and fake news – and to direct people with symptoms to appropriate services, thus helping to identify cases. The hotline, setup a week before the first case was reported, has received, on average, 150 calls a day. <https://gisbarbados.gov.bb/blog/covid-19-contact-information-at-a-glance/>

294 BGIS. 2019. "Old Naval Base as could be used for COVID-19". <https://gisbarbados.gov.bb/blog/old-naval-base-could-be-used-for-covid-19/>

295 BGIS. 2019. "Harrison Point receives first patients". <https://gisbarbados.gov.bb/blog/harrison-point-receives-first-patients/>

relations<sup>296</sup>, additional nurses and renown medical practitioners from Cuba<sup>297</sup> and Ghana were engaged during March 2020.

Additionally, a Best-Dos Santos Laboratory<sup>298</sup> was developed to screen all COVID-19 tests on the island. This laboratory is the first of its kind in the Caribbean to acquire test kits<sup>299</sup> and reagents for COVID-19 detection<sup>300</sup>. To support the implementation of the virus detection in Barbados, PAHO conducted a two-day training workshop. This workshop was facilitated by Dr. Lionel Gresh and commenced on February 10th, 2020 at the Best-Dos Santos Public Health Laboratory. Workshop sessions included a review of current knowledge about this novel pathogen and hands-on implementation in virus detection. The following figure depicts the state of the art facilities and equipment across Barbados to manage the influx of COVID-19 patients and to conduct screening activities by renown medical professionals.

**Figure 78: State of the Art facilities and Equipment in Barbados to address COVID-19**



Source: PAHO, 2020; BGIS, 2020

- 296 BGIS. 2019. "Deeper Health Cooperation with Cuba". <https://gisbarbados.gov.bb/blog/deeper-health-cooperation-with-cuba/>; <https://gisbarbados.gov.bb/blog/six-more-months-for-cuban-nurses-in-barbados/>.
- 297 BGIS. 2019. "Cuban Nurses on the way to help in COVID-19 fight". <https://gisbarbados.gov.bb/blog/cuban-nurses-on-the-way-to-help-in-covid-19-fight/>; <https://gisbarbados.gov.bb/blog/barbados-cuba-sign-a-health-cooperation-agreement/>.
- 298 Pan-American Health Organization. 2021. "PAHO prepares Barbados for COVID-19 testing". <https://www.paho.org/en/stories/paho-prepares-barbados-covid-19-testing>
- 299 The provision of COVID-19 test kits and training were made possible by PAHO Health Emergencies Department, who has worked in close collaboration with the Ministry of Health and Wellness to enhance national capacity in response to the Public Health Emergency of International Concern (PHEIC).
- 300 As a result of a PAHO donation of testing kits and enzymes, procurement through the U.N. system, and purchases on the open market, the country has been able to procure 20,000 test kits. The laboratory has conducted more than 13,000 tests to date and has capacity for over 100,000 tests at hand to continue testing well into the future.

Arriving passengers at different ports of entry were required to take a COVID-19 test prior to arrival. They were screened upon entry at the airport or seaport and were required to transcribe their designated location of stay and contact information. These measures were put in place to monitor the movements of persons via contact tracing to minimise the spread of the disease. In instances where individuals were potentially exposed to the virus yet presented symptoms that were less severe, they were asked to quarantine for a period of 14 days thereby isolating themselves from members of their household and recreational areas. Volunteers of the Barbados Statistical Service ventured to homes around Barbados and conversed with householders within the bounds of their premises to ascertain the feasibility of home isolation noting the potential competing demands for residential amenities. In the case of tourists, they were transferred to quarantine-earmarked hotels until a negative COVID-19 test was attained. In February 2021, the GoB issued Emergency passes for frontline and essential workers<sup>301</sup> as well as instituted a Stay-At-Home Directive for remaining segments of the population. In October 2021, the GoB embarked upon a Home Quarantine and Isolation Programme<sup>302</sup> to ease the burden placed on national facilities. The PAHO noted that during the latter segment of September 2021, there were approximately eight thousand (8000) confirmed new cases of the COVID-19 virus across Barbados as well as six Eastern Caribbean Countries<sup>303</sup>. This not only represented a 52% increase in cases when compared to the previous month, but also posed significant challenges to public goods and services. These included severe capacity constraints for hospitals and isolation centres, reagents, other medical supplies and staff complements<sup>304</sup>. During such time, Barbados attained a positivity rate of 10% and new cases were highly prevalent amongst the unvaccinated segment of the population ranging between 83-95% across respective Member States. In addition to this, approximately 15-25% of children succumbed to the highly transmissible Delta Variant

of the illness. The increase of cases was largely observed in persons who are unvaccinated for Covid-19. Of the newly reported cases, a proportion of 15-25% were children under the age of 18 years of age. This caused grave national concern for this vulnerable segment of the Barbadian population.

The National Emergency Management System supported national efforts in combating the COVID-19 pandemic. The Ministry of Home Affairs and Information, the Ministry of Health and Wellness, the DEM along with the CDEMA, PAHO and donor countries such as Canada, United States of America, the United Kingdom and China were instrumental in coordinating the arrival of various types of COVID-19 vaccines on the island<sup>305</sup>. Barbados received its first COVID-19 vaccines on April 6th, 2021 through the COVAX Facility (as seen in Figure 79). This facility represents a global effort between the Coalition for Epidemic Preparedness Innovations (CEPI), Gavi, the Vaccine Alliance Gavi, UNICEF, the Pan-American Health Organization (PAHO) and the World Health Organization (WHO). PAHO's Revolving Fund, which is responsible for the procurement of COVID-19 vaccines for the countries of the Americas under the COVAX Mechanism, sent 33,600 doses of the AstraZeneca/Oxford vaccine, manufactured by SK Bioscience of South Korea to the island. Vaccine supplies were expected to continue until at least 20% of the most vulnerable segments of the Barbadian population were immunized<sup>306</sup>. Barbados received its second COVID-19 vaccines through the COVAX Facility on May 11<sup>th</sup>, 2021<sup>307</sup>. In its efforts to adequately safeguard the elderly and those with compromised immunological responses; the government mandated that the first and second batches of the AstraZeneca/Oxford vaccine will be primarily administered to these segments of the population. Special consideration was also made for frontline and essential workers. Barbados received its third COVID-19 vaccines through the COVAX Facility on August 24<sup>th</sup>, 2021<sup>308</sup>. This tranche brought the total of the national vaccines derived from the COVAX Facility to 100,800 doses.

301 BGIS. 2021. "Employees must have a pass not letter from employer". <https://gisbarbados.gov.bb/blog/employees-must-have-a-pass-not-letter-from-employer/>

302 BGIS. 2021. "Home Quarantine & Isolation to ease Facilities". <https://gisbarbados.gov.bb/blog/home-quarantine-isolation-to-ease-facilities/>

303 This includes Antigua and Barbuda, Dominica, Grenada, Saint Lucia, Saint Kitts and Saint Vincent and the Grenadines.

304 Hospitals and isolation facilities in the Eastern Caribbean Countries are overwhelmed with the increase of Covid-19 cases combined by shortage of health workforce and clinical supplies. Available at: <https://www.paho.org/en/news/27-9-2021-hospitals-and-isolation-facilities-eastern-caribbean-countries-are-overwhelmed>

305 The Barbados COVID\_19 Tracker. Available at: <https://covid19.trackvaccines.org/country/barbados/>

306 Since the first case of COVID-19 was reported in March 2020, Barbados has recorded 3,946 cases and 45 deaths as a result of the SARS-CoV-2 virus. As of May 2021, 75,491 persons have been immunized, with 32,717 persons fully vaccinated.

307 This brings the total to date to 67,200 doses; the first batch was received on 06 April 2021. According to the COVAX allocations, Barbados is expected to continue receiving doses of vaccines until it reaches 100,800, the amount allocated by COVAX.

308 This brings the total to date to 103,200 persons have been immunized, with 90,675 persons fully vaccinated. Available at: <https://www.paho.org/en/news/24-8-2021-barbados-receives-its-third-batch-covid-19-vaccines-through-covax-facility>

**Figure 79: Receipt of COVAX Vaccines by the Government of Barbados**



Source: PAHO, 2021

Note: The Hon. Mia Amor Mottley, Prime Minister of Barbados; Dr. Kenneth George, Chief Medical Officer, Ministry of Health and Wellness; Dr. Yitades Gebre, PAHO/WHO Representative for Barbados and the Eastern Caribbean Countries and other government officials attended the handing over ceremony at the Grantley Adams International Airport in Barbados.

The onset of the global pandemic, even though worrisome to a Small Island Developing State like Barbados, sought to strengthen bilateral, regional and multilateral ties around the globe (as seen in Figure 80). On August 24th, 2022, the Government of the United Kingdom has provided Barbados<sup>309</sup> with 14,400 doses of the paediatric Pfizer COVID-19 vaccine for children ages five to eleven<sup>310</sup> (BGIS, 2022; CBC, 2022). The British High Commissioner to Barbados and the Eastern Caribbean, His Excellency, Scott Fursedonn-Wood, officiated the exchange of COVID-19 vaccines to the Ministry of Health and Wellness. On November 4th, 2021, The United States of America donated 70,200 Pfizer vaccines free of charge. This was supplemented with an additional tranche of 129,700 vaccines on February 17th, 2022<sup>311</sup>. The USA Ambassador to Barbados, Linda Tagliatela officiated the exchange of COVID-19 vaccines to the Ministry of Health and Wellness. Additional COVID-19 vaccines and essential supplies were derived from Canada and the Pan-American Health Organization. Dr. Yitades Gebre, the PAHO/WHO Representative to Barbados and the Eastern Caribbean Countries (PWR-ECC)<sup>312</sup> as well as Ms. Natalie Hutchinson, Senior Development Officer, High Commission of Canada to Barbados and OECS officiated that handover to the Ministry of Health and Wellness.

309 BGIS. 2022. "Barbados receives Pfizer COVID-19 vaccines for children 12 and under". <https://www.youtube.com/watch?v=tzjwVSGYeY>.

310 BGIS. 2022. "Barbados receives Pfizer COVID-19 Vaccines for Children". <https://gisbarbados.gov.bb/blog/barbados-receives-pfizer-covid-19-vaccines-for-children>

311 BGIS. 2022. "USA Donates Pfizer to Barbados. Available at: <https://gisbarbados.gov.bb/blog/barbados-receives-129600-vaccines-from-us/> and <https://gisbarbados.gov.bb/blog/70200-pfizer-vaccines-arrive-in-barbados/>.

312 Available at: [https://www3.paho.org/ecc/index.php?option=com\\_content&view=article&id=716:pwr-ecc-presents-credentials-to-minister-of-foreign-affairs-in-barbados&Itemid=332](https://www3.paho.org/ecc/index.php?option=com_content&view=article&id=716:pwr-ecc-presents-credentials-to-minister-of-foreign-affairs-in-barbados&Itemid=332)

**Figure 80: Donor Agencies in Barbados – A Collective Body against COVID-19**



Source: PAHO 2020

Note: The Hon. Mia Amor Mottley, Prime Minister of Barbados; Lt. Col. the Hon. Jeffrey Bostic, Minister of Health and Wellness; Dr. Yitades Gebre, PAHO/WHO Representative for Barbados and the Eastern Caribbean Countries; Ms. Linda Tagliatela, Ambassador of the United States of America; Mr. Teruhiko Shinada, Ambassador of Japan; Ms. Malgorzata Wasilewska, Ambassador of the European Union; Mr. Scott Fursessedonn-Wood, British High Commissioner for Barbados and the Eastern Caribbean; Mr. Aloys Kamuragiye, Representative UNICEF Office and Acting Resident Coordinator, United Nations Office in Barbados; Ms. Ann Cleminson, Charge d’Affaires, High Commission of Canada, and other government officials attended the handing over ceremony at the Grantley Adams International Airport.

Barbados also rendered its support to COVID-19 resilience efforts across the CARICOM Member States and Associated Members (as seen in Figure 81). Cognisant of the fact that effectively combating the virus required strong and inclusive leadership based on a top-down approach with an inherent moral code, high level forums were conducted in March 2020 to (i) coordinate regional, sub-regional and national response; (ii) promote knowledge sharing via lessons learned and (iii) lend assistance in achieving desired outcomes to avert future crises.

The COVID-19 Pandemic revealed the nature of its systemic nature of risk causing ripple effects across all sectors – particularly for tourism and commerce. The existence of informal sectors predominates the Caribbean landscape. Such sectors were significantly impacted by the pandemic, thereby increasing unemployment rates and the extent of poverty and inequality across the archipelago. A 2020 study conducted by UNECLAC found that women represent the larger portion of persons employed in the accommodation and food service activities that are key within the tourism sector, thereby suggesting that women have been especially affected by the economic fallout of the pandemic<sup>313</sup>. This realization further widens inequality gaps.

313 Mulder, Nanno. 2020. The impact of the COVID-19 pandemic on the tourism sector in Latin America and the Caribbean, and options for a sustainable and resilient recovery. International Trade. UNECLAC.

Figure 81: CARICOM High-Level Forum on COVID-19



Source: PAHO, 2020

The pandemic also exacerbated underlying national and regional vulnerabilities:

- An extremely heavy reliance on the sole public medical facility on the island;
- A paucity of institutional arrangements within primary, secondary and tertiary institutions to revamp syllabuses using different modalities;
- A lack of technological resources readily available and accessible to vulnerable segments of the population;
- A prevalence of cultural practices that encourage the spread of the COVID-19 coronavirus;
- A potential reluctance to support neighbouring territories based on historical or current relations.

COVID-19 has ultimately slowed the path towards the achievement of the targets under the 2030 Agenda for Sustainable Development. Despite this, the pandemic also provides an opportunity to 'build back better' as the country is on its path to recovery. As an immediate mode of social protection, the

GoB embarked upon its Adopt-A-Family Initiative<sup>314</sup> (as seen in Box 7) to support the abject poor – particularly women, children, the elderly and the disabled. However, as the spread of the COVID-19 threat lessened on the island, the GoB embarked upon a Welcome Stamp Initiative (as seen in Box 8) to facilitate the extended stay of visitors and Barbadian expatriates who wish to conduct work-from-home modalities in this preferred Caribbean destination. This initiative was employed to increase tourist arrivals and to quell the negative impacts posed on the tourism industry – the mainstay of the Barbadian economy and associated industries.

314 PAHO. 2021. "Barbados - An example of government leadership and regional cooperation in containing the COVID-19 virus". <https://www.paho.org/en/documents/barbados-example-government-leadership-and-regional-cooperation-containing-covid-19-virus>

## Box 7 - Calling upon the local and emigrant community to help those most in need during the COVID emergency: The Adopt a Family Programme

### General Overview

With the economic devastation resulting from the suspension of tourism and the lockdown, including a nearly four-fold increase in unemployment (to 40%), the Government of Barbados has established the innovative Adopt a Family Programme as part of a large stimulus package to assist individuals and local businesses. Corporations and well-off Barbadians, including those living overseas, are encouraged to contribute to a government fund that provides cash assistance (BD\$600 or US\$300 per month) to the neediest families. Contributions can be made through WhatsApp or through local banks.



As of July 14, 2021 the fund, which garnered considerable media attention, has received BD\$5 million, with the Government contributing \$2.9 million and private donors, including from the U.S., contributing \$2.1 million. While 1,500 families were initially targeted, the private donations have enabled the program to assist nearly 3,000 families, who are issued debit cards.

Source: The Pan-American Health Organization

## Box 8 - Taking advantage of Barbados' low-risk COVID status to entice foreigners to work remotely from its beaches: The Welcome Stamp Visa Programme

### General Overview

While Barbados hasn't closed its borders due to the COVID-19 pandemic, once it announced a 14-day quarantine for all travelers from Europe and the U.S., along with the suspension of cruises, tourism effectively stopped on the island. With tourism accounting for more than 40% of the nation's economy and a major source of foreign exchange earnings, this has had a devastating economic impact in a country that was already one of the most indebted countries in the world in terms of debt to GDP ratio (at 118% in 2020)<sup>315</sup>.



With the incidence of COVID-19 remaining low, leading to the lifting of curfews on July 1 and the phased-in resumption of international flights starting in mid-July (based on the COVID risk in originating countries), Barbados has decided to promote itself as an oasis from COVID for foreigners able to work remotely. A brainchild of Prime Minister Mottley, the Welcome Stamp Visa program, started in mid-July, offers tax-free stays for 12 months or longer for workers and businesses that are location-independent. To further attract long-term visitors, the application submitted on-line is processed within 48 hours and the visa processed within seven days.

As the Prime Minister has stated, "COVID-19 has placed a severe strain on people's mental wellness. The sunshine is powerful. The seawater is powerful. They're both therapeutic in ways that are hard to explain. And we felt that, why not share it?" According to the Washington Post, the message is: "Come here, not just for a holiday but for up to a year. Bring your laptop. Soak up the sun, sea and sand and forget about coronavirus"<sup>316</sup>. The appeal of Barbados as a long-term destination is enhanced by its political stability, well-developed tourism infrastructure, relatively high standard of living and the fastest fiber-optics Internet and mobile services in the Caribbean.

The focus on longer-term stays and permanent relocation of professionals and businesses is seen as having many of the same economic benefits, including foreign exchange earnings, as short-term tourism, while reducing the risk of importing COVID that a greater number of short-term visitors would entail. Strict protocols have been put in place for all visitors to minimize this risk, including temperature checks at the airport, and confirmation of a negative COVID test result taken within 72 hours prior to arrival, or submission to testing at the airport, followed by quarantine until the test results are received. This program may become a model for other tourism-dependent countries that remain at low-risk of COVID transmission and is already being examined by other Caribbean Island countries.

Source: The Pan-American Health Organization

315 UNDP, UNICEF, UN Women. 2020. "Barbados COVID-19 HEAT Report, Human and Economic Assessment of Impact".

316 The Washington Post. 2020. "Barbados wants you to work from its beaches during the pandemic". [www.washingtonpost.com/world/2020/07/16/barbados-work-remote-coronavirus/](https://www.washingtonpost.com/world/2020/07/16/barbados-work-remote-coronavirus/).

Overall, the Prime Minister of Barbados was lauded<sup>317</sup> for her rapid, highly coordinated and comprehensive national response to the COVID-19 Pandemic<sup>318</sup>. She also emphasized the need to adopt a proactive stance and be fit for purpose in the event of future crises<sup>319</sup>. Similarly, the PAHO was awarded with the island's highest Humanitarian Award: 'The Honorary Freedom of Barbados Award' by the GoB on two separate occasions (during May 2022<sup>320</sup> and November 2022<sup>321</sup>) in recognition of the leadership and support it rendered during the COVID-19 pandemic. As of September 22nd, 2022, 57% of the Barbadian population has been fully vaccinated. The GoB was provided with a series of vaccine boosters to ensure full coverage – particularly for the most vulnerable groups within the population. There is still some measure of vaccine hesitancy amongst a minority of the population and social distancing restrictions were relaxed to three feet. As of September 22nd, 2022, a total of 17 new cases were reported. This included 7 males and 10 females out of the 282 tests that were conducted at the Best-Dos Santos Laboratory and other medical facilities across Barbados. A summary of the COVID-19 Situation can be seen in Figure 82. As of September 22nd, 2022, the Cabinet of Barbados approved a number of fundamental changes to its mask mandate and travel protocols<sup>322</sup> (as seen in Box 9).

**Figure 82: The Barbados COVID-19 Situational Report (September 22, 2022)**



Source: The Barbados Government Information Service

317 CNN. 2020. "CNN interview with P.M. Mottley by Christiane Amanpour". <https://www.youtube.com/watch?v=awL3tKAFiU8>.

318 BGIS. 2019. "Prime Minister praised for Handling of COVID-19 fight". <https://gisbarbados.gov.bb/blog/prime-minister-praised-for-handling-of-covid-19-fight/>

319 BGIS. 2022. "Prime Minister Mottley: Lessons To Be Learnt From COVID-19 Fight". <https://gisbarbados.gov.bb/blog/prime-minister-mottley-lessons-to-be-learnt-from-covid-19-fight/>

320 Pan American Health Organization. 2022. "PAHO receives Humanitarian Award from Barbados for its support during the COVID-19 pandemic". <https://www.paho.org/en/news/5-5-2022-paho-receives-humanitarian-award-barbados-its-support-during-covid-19-pandemic>

321 BGIS. 2022. "Second Humanitarian Awards Ceremony November 20". <https://gisbarbados.gov.bb/blog/second-humanitarian-awards-ceremony-november-20/>

322 BGIS. 2022. "Government Announces Changes To Mask Wearing Mandate". <https://gisbarbados.gov.bb/blog/government-announces-changes-to-mask-wearing-mandate/>

## Box 9 - Government Announces Changes To Mask Wearing Mandate

### General Overview

Effective Friday, September 23, 2022, the wearing of face masks as the best defence against COVID-19 is now optional, but with a few exceptions.

Acting Prime Minister Santia Bradshaw in a post Cabinet press conference at Ilaro Court on Thursday evening, said the changes took effect from midnight. However, the wearing of masks would be mandatory on public transportation, in schools, medical facilities such as hospitals, dental offices, clinics, nursing homes and day-care institutions. She also revealed that from today, all entry requirements at this country's ports of entry would be relaxed for vaccinated and unvaccinated passengers.



"Conscious of the direction in which the rest of the world is going, effective tomorrow (today), we will also discontinue all COVID-19-related travel protocols for Barbados, joining 95 per cent of the countries in the hemisphere who preceded Barbados in going in this direction. This means that there will be no testing requirements for entering Barbados whether you are vaccinated or unvaccinated," Ms. Bradshaw proffered.

The Acting Prime Minister also warned that the elderly population and those considered high-risk, should still wear their masks to protect themselves. She stated: "Individuals who are at increased risk for illness or death due to COVID-19, particularly the elderly and those with health conditions, may find it prudent to continue wearing masks around others."

She added: "Those who come in close contact with such vulnerable persons are also encouraged to wear masks and practise good hand and respiratory hygiene. I also encourage you to make use of the available COVID-19 vaccinations and boosters that provide another layer of protection against the virus."

Ms. Bradshaw also revealed that Barbados' positivity rate continued to fall and now stood at "a reasonable 12 per cent" which is down from the "worrying" 26 per cent which existed over a month ago.

The Acting PM, who is also the substantive Minister of Transport and Water Resources, commended Barbadians for staying the course over the past 18 months especially during those periods when the country faced a significant spike in the viral illness.

"Despite all that we have been through, we did not retreat...We did not surrender. Yes, we may all be battered and bruised and lost many friends, family and loved ones along the way. I know that we are all a little, or a lot, COVID-19 fatigued. But we are now at that point where we can strive to turn the corner at this latest phase in our management of the COVID-19 pandemic," Ms. Bradshaw underlined.

The Acting Prime Minister encouraged Barbadians not to drop their guard adding that the COVID-19 has not been eradicated from our island and that the onus was on each individual to behave responsibly.

Attorney General Dale Marshall who was also present, stated that the COVID-19 directive remains in place while Minister of Tourism and International Transport Lisa Cummins, expressed optimism that the change would lead to renewed interest in Barbados as a destination for the upcoming winter season.

Source: Barbados Government Information Service

# Summary of Gaps

## Chapter 8 Overview

This chapter highlights existing gaps within the National Disaster Management Framework for Barbados. It acknowledges the need to strengthen institutional arrangements and to improve the efficiency and effectiveness of sectoral mainstreaming, community planning and knowledge management techniques. It also seeks to address capacity constraints for national response, recovery and rehabilitation in efforts to build resilience to disasters and contribute to the achievement of sustainable development.

### 8. Summary of Gaps

The National Disaster Risk Management framework for Barbados supports continued economic growth and risk investment. However, a number of areas require strengthening to improve the country's resilience to disasters and to contribute to the achievement of sustainable development. These areas have been discussed in greater detail within the previous sections but are summarised below:

**Figure 83: Summary of Gaps within the National Disaster Management Framework**

### **Institutional Arrangements**

- Limited legislative frameworks regarding climate change and adaptation
- Limited sectoral legislation mandating CDM responsibilities
- Limited policy frameworks for disaster legislation to support the national CDM/DM/DRM policy
- A lack of a local governance structure to support disaster resilience efforts
- Limited sustainability planning
- No national incentive schemes to reduce vulnerability and exposure: work place resilience, relocations and or housing/building retrofitting; protection of productive assets
- No legal requirement in the acquisition of insurance to support risk financing for residential policies
- No legal requirements for local level risk assessments.
- No legal requirement in the development, usage or reporting of hazard assessments
- Low human resource capacity within the NEMS
- Insufficient funds allocation to the NEMS
- Unavailability of a Monitoring, Evaluation and Reporting framework for implementation of DRR and the 2030 Agenda
- Unclear responsibilities among stakeholders
- Inadequate coherence across all sectoral and national policies
- Unenforced building codes
- No formal legislative authority to oversee the development and finalization of the national building codes
- No technical inspections/resources to monitor and enforce the application of building codes
- A paucity of business continuity plans for state institutions

### **Sectoral Mainstreaming**

- Inadequate business continuity planning for sectors
- Inadequate mainstreaming across sectors
- Insufficient investment in sectoral mainstreaming
- Limited implementation of the Pan American Health Organisation (PAHO) SMART hospital program

### **community Planning**

- Need to expand, integrate and maintain hazard monitoring systems to meet current and changing needs.
- Limited quality controlled, historical and real-time sectoral data at appropriate spatial and temporal scales.
- Limited data sharing and exchange across the MHEWS community.

## Knowledge Management

- A paucity of information on the various subsidiary standards under the hazard assessment
- Lack of a standardized reporting format for the island's multi-hazard risk profile for various end users.
- Unavailability of disaggregated data and inaccessibility of useful resources at all levels and to all stakeholders via different modalities
- A Lack of nationally published studies to support hazard mapping priorities
- Limited engagements with local communities, NGOs and other stakeholders participate in the preparation, revision, publication and distribution of hazard maps.
- Unavailability of updated methodologies or tools available for multi-risk assessments and cost benefit analysis
- No nationally designated authority to facilitate integrated hazard modelling processes
- Existing technical complexity and limited tailoring of information for various end users
- Limited user and provider capacity for EWS service use and development
- Incomplete Multi-Hazard Early Warning System
- Unavailability of a formalised public awareness strategy
- Limited capacity for data collection, analysis and dissemination
- No evidence of an application to support GIS technologies for risk mapping and modelling
- Limited integration of CDM into education curricula
- Lack of information on structural mitigation for new and old facilities
- No National database to record disaster losses
- A lack of information on environmental restoration, conservation enhancement
- A paucity of information regarding the enforcement of insurance and renewal scheduled for business license and crop insurance available to farmers

## Capacity for response, recovery and rehabilitation for resilience

- Lack of monitoring, evaluation and reporting (MER) frameworks for measuring progress on climate services development
- Limited functionality and integration of decisions, support platforms and tools to support sector-specific and cross-sectoral impacts-based forecasting
- Lack of sector-specific and cross-sectoral research on impact-based forecasting
- Limited hazard, environmental and social science research to inform the production of tailored, sector-specific information on regional, national and community scales
- Lack of interdisciplinary demand-driven early warning services research and innovation
- Lack of an effective post-disaster recovery process
- Limited response to ensure full Return to Normalcy
- Lack of revitalization for Affected Sectors
- Lack of prioritization of the Government's Contingency Continuity Plan and the Business Continuity Plan
- Lack of alignment of key sectors to support business continuity plans
- Need to strengthen public-private sector partnerships

# Priority Areas for Action

## Chapter 9 Overview

This chapter highlights the priorities of action as detailed within the Barbados Comprehensive Disaster Management (CDM) Country Work Programme (2019-2023) in adherence to the regional Comprehensive Disaster Management (CDM) Strategy and Programming Framework 2014-2024. Within the Barbados Comprehensive Disaster Management Country Work Programme, the actions outlined seek to promote institutional strengthening, disaster preparedness and recovery, community resilience and knowledge management. This chapter also acknowledges the strides made via ministerial and or departmental coordination whilst recognising gender, climate change, ICT and environmental sustainability as key cross-cutting themes.

priority areas for national policies and strategies. These proposed interventions should also elaborate further on activities, timeframes, budgets and indicators to facilitate the implementation of initiatives in support of the desired national outcomes.

## 9. Priority Areas for Action

The problems, issues and needs as revealed by this study have informed the recommendation of potential priority areas for the implementation of the existing Country Work Programme<sup>323</sup> as well other national and sectoral policies and strategies, in support of a resilient nation and the sustainable development agenda. Table 23 establishes these priority areas as emphasized as programme areas and are later disaggregated into outcomes and outputs for the policy environment. Considerations for gender, climate change, ICT and environmental sustainability should be treated as cross-cutting themes, in adherence with the regional CDM Strategy and Programming Framework 2014-2024. These proposed interventions should be deliberated through stakeholder consultations to agree on the

<sup>323</sup> The Barbados Comprehensive Disaster Management (CDM) Country Work Programme (CWP) 2019-2023 is a multi-year, results-based programme developed by the partners of the National Emergency Management System (NEMS). Stakeholders agreed on five (5) Programme Areas for work over the next four (4) years. Each area has at least one (1) Outcome with several associated Outputs to be achieved.

**Table 23: Priority Areas for the Consideration in the Country Work Programme and National/Sectoral Policies and Strategies**

Priority Area	Outcomes	Priority Action(s)	Outputs	Prioritized Activities
Programme Area 1 – Institutional Strengthening for Comprehensive Disaster Management	Outcome 1.1 Strengthened enabling environment for Comprehensive Disaster Management	This Outcome will strengthen the legislative and regulatory frameworks, standards and business processes for disaster management, channel more financial resources towards implementing disaster risk management (DRM) programmes and projects and improve capacity for monitoring	Output 1.1.1 CDM integrated into national policy and legislation	<ul style="list-style-type: none"> <li>• Publish the CDM Policy Statement. Review and enhance the Emergency Management Legislation.</li> <li>• Develop appropriate regulations for emergency and disaster management.</li> </ul>
			Output 1.1.2 NEMS strengthened for effective implementation monitoring and reporting	<ul style="list-style-type: none"> <li>• Conduct DRM capacity assessments such as the CDM Audit and the iGOPP.</li> <li>• Publish the results of the CDM Audit and other assessments of DRM capacity.</li> <li>• Monitor, evaluate and report on the CWP and its activities</li> </ul>
			Output 1.1.3 National DRM Programme adequately funded	<ul style="list-style-type: none"> <li>• Develop mechanisms for tracking DRM funding and investment.</li> <li>• Report on the level of DRM funding and investment</li> </ul>
Programme Area 2 – Preparedness Response and Mitigation Capacity	Outcome 2.2 CDM mainstreamed into key sectors	This Outcome seeks to better integrate disaster risk management into key sectors and emerging sectors, with focus on the finance, blue economy and energy sectors, and the private sector. The NEMS will work with key strategic partners in each of these sectors to build their capacities for disaster mitigation, preparedness, response and recovery and implement initiatives that build resilience in their respective sectors, utilising existing knowledge of hazards, vulnerability and risk.	Output 2.2.1 DRM Strategies established for key sectors	<ul style="list-style-type: none"> <li>• Integrate DRM in to the strategies of key sectors specifically: <ul style="list-style-type: none"> <li>- The Blue Economy.</li> <li>- Finance, Economic Affairs and Investment.</li> <li>- Renewable Energy.</li> <li>- Private Sector.</li> </ul> </li> </ul>
			Output 2.2.2 Risk-informed CDM Work Programme implemented for key sectors.	<ul style="list-style-type: none"> <li>• Establish the National Building Authority and increase the resources to support its functions.</li> <li>• Enact the National Building Code.</li> <li>• Implement the “Roofs to Reefs” project.</li> <li>• Strengthen/upgrade hurricane shelters to resist the impacts of major hurricanes.</li> <li>• Develop designs for resilient low and lower-middle income public housing.</li> <li>• Develop risk maps of national heritage collections including archives.</li> <li>• Install a fire suppression system at the National Archives.</li> <li>• Develop a paper on innovative incentives that will promote DRM in the private sector.</li> </ul>

Priority Area	Outcomes	Priority Action(s)	Outputs	Prioritized Activities
Programme Area 3 - Strengthening Community Resilience	Outcome 3.1 Strengthened community mitigation, preparedness and response	This Outcome seeks to improve the capacity of communities and ordinary citizens to assess their risk and develop proactive plans to reduce vulnerability, as well as strengthen Early Warning Systems for these communities.	Output 3.1.1 Community Based Early Warning System established in vulnerable communities	<ul style="list-style-type: none"> <li>Install EWS in three (3) vulnerable communities.</li> <li>Pursue Tsunami Ready® recognition for vulnerable communities.</li> <li>Develop/review and update community disaster management plans (DEOs).</li> <li>Conduct regular exercise to test community disaster plans</li> </ul>
			Output 3.1.2 Community-based Disaster Management Programme strengthened for vulnerable groups	<ul style="list-style-type: none"> <li>Publish the CDM Policy Statement.</li> <li>Review and enhance the Emergency Management Legislation.</li> <li>Develop appropriate regulations for emergency and disaster management.</li> <li>Implement national clean-up campaigns.</li> </ul>
Programme Area 3 - Strengthening Community Resilience	Outcome 3.2 Community livelihoods sustained through effective risk management	This Outcome focuses on better access to risk transfer for at-risk communities and groups, and stronger livelihood and social protection mechanisms	Output 3.2.1 Risk Catastrophe Insurance Mechanisms established and implemented for vulnerable groups	<ul style="list-style-type: none"> <li>Develop a catastrophe and risk insurance product for chattel houses, crops, fisheries.</li> </ul>
			Output 3.2.2 Social Protection Programmes strengthened	<ul style="list-style-type: none"> <li>Review social protection programmes to integrate disaster mitigation, preparedness and recovery considerations.</li> <li>Implement an enhanced psycho-social support programme inclusive of training</li> </ul>
Programme Area 4 - Research and Knowledge Management	Outcome 4.1 Risk informed development planning regulations and decision making	This Outcome aims to improve hazard monitoring, forecasting and mapping, strengthen data and information management by improving repositories of hazard information and promote the use of this knowledge in the implementation of NEMS work programmes.	Output 4.1.1 Risk assessment enhanced through hazard monitoring, forecasting and mapping	<ul style="list-style-type: none"> <li>Establish a risk data/information platform for DRM and CCA and update/enhance regularly.</li> <li>Conduct training in hazard/risk mapping.</li> <li>Develop GIS-based risk maps and geo-referenced records of hazard impacts.</li> <li>Expand the body of DRM knowledge through research specific to the Barbados context including studies on the historical impact of hazards.</li> </ul>
			Output 4.1.2 National repository for hazard knowledge improved	<ul style="list-style-type: none"> <li>Review existing repositories of DRM knowledge.</li> </ul>

Priority Area	Outcomes	Priority Action(s)	Outputs	Prioritized Activities
Programme Area 4 - Research and Knowledge Management	Outcome 4.2 Learning for CDM enhanced	This Outcome addresses both formal and informal avenues of learning about DRM and will improve the NEMS' capacity to implement Public Awareness and Education Programmes (PAE), increase the opportunities for NEMS members to be exposed to current DRM knowledge and thinking, and infuse DRM concepts more deeply into the primary and secondary curricula.	Output 4.2.1 DRM integrated into the curriculum of education institutions	<ul style="list-style-type: none"> <li>Review primary and secondary curricula to identify areas for integrating CDM.</li> <li>Introduce CDM learning materials at all levels.</li> <li>Conduct training for teacher in the use of CDM learning materials.</li> <li>Develop a Safe School Policy and pilot a Safe School Programme in schools.</li> </ul>
			Output 4.2.2 DRM education, training, and knowledge sharing opportunities available to the NEMS	<ul style="list-style-type: none"> <li>Identify knowledge building opportunities for NEMS personnel.</li> </ul>
			Output 4.2.3 Public Awareness Programme strengthened	<ul style="list-style-type: none"> <li>Develop new PAE programmes for DRM including a preparedness checklist for businesses, articles in newsletters and other publications.</li> <li>Add new social media platforms.</li> <li>Develop content for social media platform.</li> <li>Conduct Social media training for key personnel.</li> </ul>
Programme Area 5 - Recovery	Outcome 5.1 Enhanced National Recovery Framework	This Output addresses increasing the available ex ante risk financing facilities and improving access to existing facilities, improving continuity of government planning, promoting Business Continuity Planning (BCP) with private and public sectors and improving mechanisms for providing post-disaster support the population (particularly psychological recovery).	Output 5.1.1 Continuity of Government arrangement established	<ul style="list-style-type: none"> <li>Prepare a paper on Continuity of Government.</li> <li>Enhance the Continuity of Government plan.</li> <li>Conduct exercises (table top, functional) to test the Continuity of Government plan.</li> <li>Conduct research on BCP in the private sector.</li> <li>Design a model template for BCP for small and medium sized enterprises.</li> </ul>
			Output 5.1.2 Business Continuity Planning (BCP) for key sectors established	<ul style="list-style-type: none"> <li>Conduct research on BCP in the private sector.</li> <li>Design a model template for BCP for small and medium sized enterprise</li> </ul>

Priority Area	Outcomes	Priority Action(s)	Outputs	Prioritized Activities
Programme Area 5 - Recovery	Outcome 5.1 Enhanced National Recovery Framework	This Output addresses increasing the available ex ante risk financing facilities and improving access to existing facilities, improving continuity of government planning, promoting Business Continuity Planning (BCP) with private and public sectors and improving mechanisms for providing post-disaster support the population (particularly psychological recovery).	Output 5.1.3 Policy and procedures for ex ante disaster recovery planning	<ul style="list-style-type: none"> <li>Review the governance arrangements for the Catastrophe Fund to strengthen access to the fund.</li> <li>Establish a Contingent Credit Facility.</li> </ul>
			Output 5.1.4 Psychological Support Programme strengthened	<ul style="list-style-type: none"> <li>Expand and formalise the Psychosocial Support Programme within the NEMS.</li> <li>Develop SOPs for the integration of a Psychosocial Support Programme into the existing NEMS.</li> <li>Conduct training in psycho-social support.</li> <li>Develop a communication strategy to raise awareness of the Psychosocial Support Programme.</li> </ul>

Source: The Barbados Comprehensive Disaster Management (CDM) Country Work Programme (CWP) 2019-2023

## 9.1 Addressing Systemic Risk

COVID-19 has served as the clarion call for systemic risk planning. Hazards and their associated impacts are not isolated. This is especially the case for climate change, that is in itself, is a complex risk with the potential to result in direct and cascading impacts across sectors and systems. Systemic risk planning must therefore be at the forefront. Countries are now challenged to strengthen risk governance for risk-informed sustainable development that is underpinned by the understanding of systemic risk and the integration of systems-based approaches across governance arrangements and tools<sup>324</sup>. In its path to recovery and realigning actions to strengthen resilience and regenerate sustainable development, Barbados, like its Caribbean counterparts, must strengthen efforts to advance systemic risk planning including:

324 ECLAC, UNDRR. 2021. "The coronavirus disease (COVID-19) Pandemic: An Opportunity for a Systemic Approach to disaster risk for the Caribbean. COVID-19 Report." <https://www.undrr.org/publication/undrr-eclac-report-coronavirus-disease-covid-19-pandemic-opportunity-systemic-approach>

### 9.1.1 Improving mechanisms to access, analyze, visualize and share data

In keeping with the Global Risk Assessment Framework and the Sendai Framework, systemic risk planning must be supported by data across sectors and systems. Understanding systemic risk calls for multi-stakeholder dialogue and collaboration that enables the consolidation of risk data (including the complex nature of vulnerability, hazards and exposures) in support of improved analytical approaches to understanding the dynamic and interconnected nature of risk, and the cascading impacts across sectors and systems<sup>325</sup>.

325 ECLAC, UNDRR. 2021. "The coronavirus disease (COVID-19) Pandemic: An Opportunity for a Systemic Approach to disaster risk for the Caribbean. COVID-19 Report". <https://www.undrr.org/publication/undrr-eclac-report-coronavirus-disease-covid-19-pandemic-opportunity-systemic-approach>

### 9.1.2 Improving inter-disciplinary, cross-sectoral, and multi-stakeholder involvement in disaster risk reduction

Beyond the need for multi-stakeholder involvement in risk data compilation, is the need for strengthened institutional mechanisms. Such mechanisms seek to create a platform for enhanced cooperation across stakeholders for actions geared towards addressing the underlying risk drivers. Institutional mechanisms must therefore support collaboration across state (interministerial and sectoral collaboration at national and subnational levels) and non-state actors, including civil society, private sector, academia, and the media. Systemic risk planning calls for a paradigm shift from recognizing the national disaster offices as the main entity for risk reduction towards mainstreaming risk reduction and management across a wide spectrum of stakeholders.

### 9.1.3 Strengthening efforts to mainstream disaster risk reduction into development planning

Mainstreaming risk reduction into development planning supports risk-informed policies and actions across sectors for systemic risk planning. Development pillars and sectors must integrate risk planning into activities in support of resilience. Key sectors such as health, tourism, transportation, housing, urban development, agriculture, water, etc. must be equipped with the necessary capacities to promote mainstreaming. Achieving this will address the underlying drivers of risk that contribute to system failure when risk is realized.

### 9.1.4 “Building back better” and integrating risk into recovery plans

In its path to recovery from COVID-19, Barbados has prepared a suite of recovery tools that aim to regenerate growth and sustainable development. The Barbados Disaster Social Relief Plan is set to steer the nation towards a path of resilience by targeting critical development components including health, economic growth, social protection, disaster risk reduction and climate change. Interventions must recognize that risk encompasses all sectors and systems. Recovery tools must therefore ensure that there is an explicit appreciation for systemic

risk planning, propelling the paradigm shift from response to risk management, integrating mitigation, preparedness and monitoring into disaster risk management processes<sup>326</sup>.

### 9.1.5 Understanding existing capacities and gaps, and strengthening arrangements

Finally, adopting and promoting systemic risk planning must first commence with an in depth assessment of national capacities, policies and frameworks, and understanding where there may be shortfalls. In recovering from the fallout of the COVID-19 pandemic and in strengthening resilience for future risks, countries must commence with a review of existing institutional and governance mechanisms to understand the barriers to effective systemic risk planning. This report provides useful information that can support Barbados in understanding some of its existing capacities and necessary areas for intervention to advance systemic risk planning efforts.

326 ECLAC, UNDRR. 2021. “The coronavirus disease (COVID-19) Pandemic: An Opportunity for a Systemic Approach to disaster risk for the Caribbean. COVID-19 Report.” <https://www.undrr.org/publication/undrr-eclac-report-coronavirus-disease-covid-19-pandemic-opportunity-systemic-approach>

# Conclusion

## Chapter 10 Overview

This chapter summarizes the findings of the study which explored the varying underlying dimensions of risk and capacities that create the risk profile for Barbados. These findings will not only be useful in laying the foundation for sectoral policies and strategies in support of the 2030 Agenda, but also in supporting the implementation of the Barbados Country Work Programme.

## 10. Conclusion

Effective disaster risk reduction demands adequate governance and shared ownership across all of society. As national solutions to global problems do not exist, the disaster risk reduction measures employed will require additional regional and international support. Barbados' National Disaster Management Framework illustrates the country's overall commitment to disaster risk reduction and consequently sustainable development. The variety of national instruments, mainly legislative documents, coupled with a wide-reaching stakeholder base represent major strengths that build upon and maintain the country's capacity for disaster resilience. Moreover, Barbados continues to demonstrate economic and social growth via the reduction of inequalities and the promotion of increased community engagements - both of which signify that the underlying drivers of vulnerability and disaster risk are currently being addressed. Despite these crucial progressive measures to date, this study revealed several areas for strengthening. These include planning for recovery with the aim of "building back better", increasing resource investments for disaster risk management, and engaging in deliberate and enforced activities for mainstreaming disaster risk reduction into development activities.

Irrespective of the extent of its current and potential hazards and underlying vulnerabilities, Barbados' current developmental status renders it unable to access funding based on the World Bank's nomenclature for receiving developmental assistance. The island's GDP per capita income (PPP) stood at US\$13,487.10 in 2021. To adequately address the island's vulnerabilities requires the development of and or enhancement of a vulnerability index to assess a country's exposure to future economic and public health risks like climate

change and the COVID-19 pandemic. Climate change can exacerbate disaster risk (creating new and augmenting existing ones), demanding that there are concerted efforts to address adaptation, mitigation and loss and damage. Both climate change and disaster risk hinder the path to sustainable development if not thoughtfully considered and planned for. As such and as advocated by the Sendai Framework for Disaster Risk Reduction and the SDGs, there is an urgent need for policy coherence which ensures coordinated and consolidated efforts while maximizing existing limited resources.

As one of the top ten most indebted countries in the world in terms of its debt to GDP ratio (which stood at 137% in 2021), this current state of affairs limits Barbados's adaptive capacity to cope with exogenous shocks such as natural hazards, oil shocks and financial shocks. Ensuring highly coordinated and consolidated efforts in support of disaster risk reduction will require greater South-South and North-South cooperation. In addition to this, disaster clauses should be retained within sovereign debt contracts to address instances of extreme events on the national front.

The Government of Barbados' Department of Emergency Management, under the auspices of the Ministry of Home Affairs and Information, is well-poised to ensure coordination and coherence across the national environment in support of building resilience and sustainable development. Furthermore, it is anticipated that the island's Medium Term Development Strategy (2020-2027) will serve as a significant entry point for mainstreaming and the harmonization of agendas. As the world recovers from the COVID-19 pandemic, other risks persist. The pandemic has also exposed and even widened underlying vulnerabilities at various levels. Therefore, there is urgent need for continued planning and improvements to systemically address risk in all its dimensions and complexities. All of society must be involved if disaster risk planning is to be deemed as effective. This study explored the varying underlying dimensions of risk and capacities that create the risk profile for Barbados. These findings will be useful in setting the foundation for sectoral policies and strategies in support of the 2030 Agenda, and in supporting the implementation of the Barbados Country Work Programme.

## REFERENCES

Akpinar-elci, M., & Sealy, H. (2014). Climate Change and Public Health in Small Island States and Caribbean Countries. *Global Climate Change and Public Health*, 279-292. doi:10.1007/978-1-4614-8417-2\_16

Albala-Bertrand, J. (1993). *The Political Economy of Large Natural Disasters with Special Reference to Developing Countries*. Oxford: Clarendon Press.

Akses Systems Caribbean Inc. (2022). *Foul Bay*. Retrieved from Barbados.org: <https://barbados.org/bcfoulbay.htm>

Barbados Advocate. (2020, November 6). *Editorial: Fire Safety Still A Priority*. Retrieved from Barbados Advocate Website: <https://www.barbadosadvocate.com/columns/editorial-fire-safety-still-priority>

Barbados Advocate. (2021, July 16). *Maintenance key to prevent sick buildings*. Retrieved from Barbados Advocate Website: <https://www.barbadosadvocate.com/news/maintenance-key-prevent-sick-buildings>

Barbados Energy Division. (2017). *Barbados National Energy Policy*. Bridgetown: Barbados Energy Division.

Barbados Fire Service. (2016). *Annual Report*. Bridgetown: Barbados Fire Service.

Barbados Government Information Service. (2019, December 21). *10 New Garbage Trucks As Promised*. Retrieved from Barbados Government Information Service Website: <https://gisbarbados.gov.bb/blog/10-new-garbage-trucks-as-promised/>

Barbados Government Information Service. (2022, February 19). *Estimates of Revenue & Expenditure Laid in Parliament*. Retrieved from Barbados Government Information Service Website: <https://gisbarbados.gov.bb/blog/estimates-of-revenue-and-expenditure-laid-in-parliament/#:~:text=Overview%202022%2D2023&text=Expenditure%20on%20goods%20and%20services,or%205.6%25%20to%20%241%2C059.6%20million>

Barbados Government Information Service. (2022, October 3). *Fire Officials Urge Individual Responsibility*. Retrieved from Barbados Government Information Service Website: <https://gisbarbados.gov.bb/blog/fire-officials-urge-individual-responsibility/>

Barbados Government Information Service. (2022, September 23). *Government Announces Changes To Mask Wearing Mandate*. Retrieved from Barbados Government Information Service Website: <https://gisbarbados.gov.bb/blog/government-announces-changes-to-mask-wearing-mandate/>

Barbados Government Information Service. (2022, November 21). *PAHO Praises Prime Minister's Leadership During Pandemic*. Retrieved from Barbados Government Information Service Website: <https://gisbarbados.gov.bb/blog/paho-praises-prime-ministers-leadership-during-pandemic/>

Barbados Government Information Service. (2022, November 16). *Second Humanitarian Awards Ceremony November 20*. Retrieved from Barbados Government Information Service Website: <https://gisbarbados.gov.bb/blog/second-humanitarian-awards-ceremony-november-20/>

Barbados Government Information Service. (2014, August 31). *After Arch Cot*. Retrieved from Barbados Government Information Service Website: <https://www.nationnews.com/2014/08/31/after-arch-cot/>

Barbados Government Information Service. (2014, March 17). *Earthquakes and Tsunamis No Stranger to Barbados*. Retrieved from Barbados Government Information Service Website: <https://gisbarbados.gov.bb/blog/earthquakes-and-tsunamis-no-stranger-to-barbados/>

Barbados Government Information Service. (2015, October 9). Hurricane Janet: Her Stories 60 Years later - Part 1. Bridgetown.

Barbados Government Information Service. (2016, February 8). Hurricane Janet: Her Stories 60 Years later - Part 2. Bridgetown.

Barbados Government Information Service. (2017, May 1). *DEM Monitoring Kick-'em-Jenny*. Retrieved from Barbados Government Information Service Website: <https://www.nationnews.com/2017/05/01/dem-monitoring-kick-em-jenny-activity/>

Barbados Government Information Service. (2018, February 9). Brittons Hill: 10 Years After The Arch Cot Cave-in. Retrieved from Barbados Government Information Service Website: <https://www.youtube.com/watch?v=B6CIEwfaqyM>

Barbados Government Information Service. (2018, July 18). *Disaster Management Partnerships "Arise"*. Retrieved from Barbados Government Information Service Website: <https://gisbarbados.gov.bb/blog/disaster-management-partnerships-arise/>

Barbados Government Information Service. (2018, February 28). *Guiding Development in Arch Cot, St. Michael*. Retrieved from Barbados Government Information Service Website: <https://gisbarbados.gov.bb/blog/guiding-development-in-arch-cot-st-michael/>

Barbados Government Information Service. (2018, March 13). *Kick-'Em-Jenny No Direct Threat to Barbados*. Retrieved from Barbados Government Information Service Website: <https://gisbarbados.gov.bb/blog/kick-em-jenny-no-direct-threat-to-barbados/>

Barbados Government Information Service. (2018, May 30). *South Coast Sewage Issue Deemed A National Crisis*. Retrieved from Barbados Government Information Service Website: <https://gisbarbados.gov.bb/blog/south-coast-sewage-issue-deemed-a-national-crisis/>

Barbados Government Information Service. (2019, June 18). *Deeper Health Cooperation with Cuba*. Retrieved from Barbados Government Information Service Website: <https://gisbarbados.gov.bb/blog/deeper-health-cooperation-with-cuba/>

Barbados Government Information Service. (2019, September 16). *Health Ministry's Advice To 'Beat The Heat'*. Retrieved from Barbados Government Information Service Website: <https://gisbarbados.gov.bb/blog/health-ministrys-advice-to-beat-the-heat/>

Barbados Government Information Service. (2019, March 2). *Old Naval Base as could be used for COVID-19*. Retrieved from Barbados Government Information Service Website: <https://gisbarbados.gov.bb/blog/old-naval-base-could-be-used-for-covid-19/>

Barbados Government Information Service. (2019, February 1). *Prime Minister praised for Handling of COVID-19 fight*. Retrieved from Barbados Government Information Service Website: <https://gisbarbados.gov.bb/blog/prime-minister-praised-for-handling-of-covid-19-fight/>

Barbados Government Information Service. (2019, July 3). *Sargassum Seaweed A Threat To Caribbean Economies*. Retrieved from Barbados Government Information Service Website: <https://gisbarbados.gov.bb/blog/sargassum-seaweed-a-threat-to-caribbean-economies/>

Barbados Government Information Service. (2019, February 28). *Significant Increase In Fires For 2019*. Retrieved from Barbados Government Information Service Website: <https://gisbarbados.gov.bb/blog/significant-increase-in-fires-for-2019/>

Barbados Government Information Service. (2020, April 24). *Attorney General Explains State of Emergency Extension*. Retrieved from Barbados Government Information Service Website: <https://gisbarbados.gov.bb/blog/attorney-general-explains-state-of-emergency-extension/>

Barbados Government Information Service. (2020). COVID-19. Retrieved from Barbados Government Information Service Website: <https://gisbarbados.gov.bb/covid-19/>

Barbados Government Information Service. (2020, March 29). *Cuban Nurses on the way to help in COVID-19 fight*. Retrieved from Barbados Government Information Service Website: <https://gisbarbados.gov.bb/blog/cuban-nurses-on-the-way-to-help-in-covid-19-fight/>

Barbados Government Information Service. (2020, May 22). *Fighting Fires With Reduced Water Use*. Retrieved from Barbados Government Information Service Website: <https://gisbarbados.gov.bb/blog/fighting-fires-with-reduced-water-use/>

Barbados Government Information Service. (2020, April 19). *Harrison Point receives first patients*. Retrieved from Barbados Government Information Service Website: <https://gisbarbados.gov.bb/blog/harrison-point-receives-first-patients/>

Barbados Government Information Service. (2020, April 11). *Shopping Schedule during COVID -19 Curfew*. Retrieved from Barbados Government Information Service Website: <https://gisbarbados.gov.bb/blog/shopping-schedule-during-covid-19-curfew/>

Barbados Government Information Service. (2020, October 6). *Six More Months For Cuban Nurses In Barbados*. Retrieved from Barbados Government Information Service Website: <https://gisbarbados.gov.bb/blog/six-more-months-for-cuban-nurses-in-barbados/>

Barbados Government Information Service. (2021, July 6). *Barbados Light & Power's Restoration Efforts Continue*. Retrieved from Barbados Government Information Service Website: <https://gisbarbados.gov.bb/blog/barbados-light-powers-restoration-efforts-continue/>

Barbados Government Information Service. (2021, July 6). *DEM Reports On Damage From Hurricane Elsa*. Retrieved from Barbados Government Information Service Website: <https://gisbarbados.gov.bb/blog/dem-reports-on-damage-from-hurricane-elsa/>

Barbados Government Information Service. (2021, July 2). *Elsa Now Beginning But Is A Dangerous Storm*. Retrieved from Barbados Government Information Service Website: <https://gisbarbados.gov.bb/blog/met-office-elsa-now-beginning-but-is-a-dangerous-storm/>

Barbados Government Information Service. (2021, February 18). *Employees must have a pass not letter from employer*. Retrieved from Barbados Government Information Service Website: <https://gisbarbados.gov.bb/blog/employees-must-have-a-pass-not-letter-from-employer/>

Barbados Government Information Service. (2021, July 9). *Environment Ministry: No More Ash Collection*. Retrieved from Barbados Government Information Service Website: <https://gisbarbados.gov.bb/blog/environment-ministry-no-more-ash-collection/>

Barbados Government Information Service. (2021, April 20). *FAQs on the effects of Ash Fall on Crop Production*. Retrieved from Barbados Government Information Service Website: <https://gisbarbados.gov.bb/blog/faqs-on-effects-of-ash-fall-on-crop-production/>

Barbados Government Information Service. (2021, October 4). *Home Quarantine & Isolation to ease Facilities*. Retrieved from Barbados Government Information Service Website: <https://gisbarbados.gov.bb/blog/home-quarantine-isolation-to-ease-facilities/>

Barbados Government Information Service. (2021, July 9). *Minister Caddle: \$87 Million Ashfall Impact*. Retrieved from Barbados Government Information Service Website: <https://gisbarbados.gov.bb/blog/minister-caddle-87-million-ashfall-impact/>

Barbados Government Information Service. (2021, September 21). *Protect Livestock during Extreme Heat Conditions*. Retrieved from Barbados Government Information Service Website: <https://gisbarbados.gov.bb/blog/protect-livestock-during-extreme-heat-conditions/>

Barbados Government Information Service. (2021, June 12). *Significant Progress Made At B's Recycling Plant*. Retrieved from Barbados Government Information Service Website: <https://gisbarbados.gov.bb/blog/significant-progress-made-at-bs-recycling-plant/>

Barbados Government Information Service. (2021, April 27). *Survey on Impact of Volcanic Ash on Farmers*. Retrieved from Barbados Government Information Service Website: <https://gisbarbados.gov.bb/blog/survey-on-impact-of-volcanic-ash-on-farmers/>

Barbados Government Information Service. (2021, April 20). *Volcanic Ash – Its Effects, Cleaning Methods & More*. Retrieved from Barbados Government Information Service Website: <https://gisbarbados.gov.bb/blog/volcanic-ash-its-effects-cleaning-methods-more/>

Barbados Government Information Service. (2022, November 4). *70,200 Pfizer Vaccines Arrive in Barbados*. Retrieved from Barbados Government Information Service Website: <https://gisbarbados.gov.bb/blog/70200-pfizer-vaccines-arrive-in-barbados/>

Barbados Government Information Service. (2022, July 8). *Attorney General Addresses Recent Increase In Gun Crimes*. Retrieved from Barbados Government Information Service Website: <https://gisbarbados.gov.bb/blog/attorney-general-addresses-recent-increase-in-gun-crimes/>

Barbados Government Information Service. (2022, May 20). *Barbados & Cuba Sign A Health Cooperation Agreement*. Retrieved from Barbados Government Information Service Website: <https://gisbarbados.gov.bb/blog/barbados-cuba-sign-a-health-cooperation-agreement/>

Barbados Government Information Service. (2022, March 21). *Barbados & Guyana Working To Improve Food Security*. Retrieved from Barbados Government Information Service Website: <https://gisbarbados.gov.bb/blog/barbados-guyana-working-to-improve-food-security/>

Barbados Government Information Service. (2022, September 30). *Barbados Reaches Deal On New Extended Fund Facility*. Retrieved from Barbados Government Information Service Website: <https://gisbarbados.gov.bb/blog/barbados-reaches-deal-on-new-extended-fund-facility/>

Barbados Government Information Service. (2022, February 17). *Barbados Receives 129,600 Vaccines From US*. Retrieved from Barbados Government Information Service Website: <https://gisbarbados.gov.bb/blog/barbados-receives-129600-vaccines-from-us/>

Barbados Government Information Service. (2022, August 27). *Barbados receives Pfizer COVID-19 Vaccines for Children*. Retrieved from Barbados Government Information Service Website: <https://gisbarbados.gov.bb/blog/barbados-receives-pfizer-covid-19-vaccines-for-children>

Barbados Government Information Service. (2022, August 26). *Barbados receives Pfizer COVID-19 vaccines for children 12 and under*. Retrieved from Barbados Government Information Service Website: <https://www.youtube.com/watch?v=tzwjvVSgYeY>

Barbados Government Information Service. (2022, September 15). *Chief Medical Officer's Advice On How To Avoid Heat Stress*. Retrieved from Barbados Government Information Service Website: <https://gisbarbados.gov.bb/blog/chief-medical-officers-advice-on-how-to-avoid-heat-stress/>

Barbados Government Information Service. (2022, October 1). *MP apologises to residents*. Retrieved from Barbados Government Information Service Website: <https://www.nationnews.com/2022/10/01/mp-apologises-residents/>

Barbados Government Information Service. (2022). *National Protocols*. Retrieved from Barbados Government Information Service Website: <https://gisbarbados.gov.bb/covid-19-protocols/>

Barbados Government Information Service. (2022, November 21). *Prime Minister Mottley: Lessons To Be Learnt From COVID-19 Fight*. Retrieved from Barbados Government Information Service Website: <https://gisbarbados.gov.bb/blog/prime-minister-mottley-lessons-to-be-learnt-from-covid-19-fight/>

Barbados Government Information Service. (2022, April 8). *Private Sector Partnerships Key To Boosting Production*. Retrieved from Barbados Government Information Service Website: <https://gisbarbados.gov.bb/blog/private-sector-partnerships-key-to-boosting-production/>

Barbados Government Information Service. (2022, May 7). *Statement on Construction of Steel-Framed Houses from China*. Retrieved from Barbados Government Information Service Website: <https://gisbarbados.gov.bb/blog/statement-by-housing-minister-on-the-construction-of-steel-framed-houses-from-china/>

Barbados Government Information Service. (2023, April 6). *Barbados Social Protection Report 2021*. Retrieved from Barbados Government Information Service Website: <https://gisbarbados.gov.bb/blog/barbados-social-protection-report-2021/>

Barbados Statistical Service. (2022). *Unemployment rate*. Retrieved from The Barbados Statistical Service Website: <https://stats.gov.bb/?s=unemployment+rate>

Barbados Today . (2022, October 13). *Region to get funding for resilience efforts*. Retrieved from Barbados Today Website: <https://barbadostoday.bb/2022/10/13/region-to-get-funding-for-resilience-efforts/>

Barbados Today. (2019, February 20). *Bad roads across Barbados*. Retrieved from Barbados Today Website: <https://barbadostoday.bb/2019/02/20/bad-roads-across-barbados/>

Barbados Today. (2020, December 8). *Rare internet outage strikes Barbados, Eastern Caribbean*. Retrieved from Barbados Today: <https://barbadostoday.bb/2020/12/08/rare-internet-outage-strikes-barbados-eastern-caribbean/>

Barbados Today. (2021, March 12). *Authorities test Tsunami Warning System*. Retrieved from Barbados Today Website: <https://barbadostoday.bb/2021/03/12/authorities-test-tsunami-warning-system/>

Barbados Today. (2021, July 2). *Elsa is the First Hurricane to hit Barbados in 65 years*. Retrieved from Barbados Today Website: <https://barbadostoday.bb/2021/07/02/elsa-is-the-first-hurricane-to-hit-barbados-in-65-years/>

Barbados Today. (2021, August 26). *Govt on a 'borrowing binge'*. Retrieved from Barbados Today Website: <https://barbadostoday.bb/2021/08/26/govt-on-a-borrowing-binge/>

Barbados Today. (2021, July 15). *Griffith: Elder abuse a big problem in Barbados*. Retrieved from Barbados Today Website: <https://barbadostoday.bb/2021/06/15/griffith-elder-abuse-a-big-problem-in-barbados/>

Barbados Today. (2021, April 14). *La Soufrière's Good Friday 1979 eruption marked by explosion*. Retrieved from Barbados Today Website: [https://barbadostoday.bb/2021/04/14/la-soufrieres-good-friday-1979-eruption-marked-by-explosion/?fbclid=IwAR2jKdEXQwFMF\\_z29Ue\\_rGNjcU05b-a9ty1mZnVX6SGY5JQyk7OsHUpat9Y](https://barbadostoday.bb/2021/04/14/la-soufrieres-good-friday-1979-eruption-marked-by-explosion/?fbclid=IwAR2jKdEXQwFMF_z29Ue_rGNjcU05b-a9ty1mZnVX6SGY5JQyk7OsHUpat9Y)

Barbados Today. (2021, September 30). *New garbage collection, recycling system rolls out*. Retrieved from Barbados Today Website: <https://barbadostoday.bb/2021/09/30/new-garbage-collection-recycling-system-rolls-out/>

Barbados Today. (2021, December 30). *Transport Board says electric buses worth it*. Retrieved from Barbados Today Website: <https://barbadostoday.bb/2021/12/30/transport-board-says-electric-buses-worth-it/>

Barbados Today. (2022, May 15). *BWA addressing burst water mains across the island*. Retrieved from Barbados Today Website: <https://barbadostoday.bb/2022/05/15/bwa-addressing-bursts-across-the-island/>

Barbados Today. (2022, April 12). *CCB concerned Bajans not speaking up about child abuse*. Retrieved from Barbados Today Website: <https://barbadostoday.bb/2022/04/02/ccb-concerned-bajans-not-speaking-up-about-child-abuse/>

Barbados Today. (2022, January 13). *Elderly man questions \$12 000 water bill*. Retrieved from Barbados Today Website: <https://barbadostoday.bb/2022/01/13/elderly-man-questions-12-000-water-bill/>

Barbados Today. (2022, August 5). *Hybrids in demand; electric vehicle sales growing slowly*. Retrieved from Barbados Today: <https://barbadostoday.bb/2022/08/05/hybrids-in-demand-electric-vehicle-sales-growing-slowly/>

Briguglio, L., Koshy, K., Nurse, L., & Wong, P. (2008). *Climate Change and Small Island Developing States*. London: Commonwealth Secretariat.

Bruckner, M. (2013, May 2). Effectively addressing the vulnerabilities and development needs of Small Island Developing States. *CDP Background Paper No. 17*, pp. 1-39. doi:ST/ESA/2013/CDP/17

Bueno, R., Herzeld, C., Stanton, E., & Ackerman, F. (2008). *The Caribbean and Climate Change - The Cost of Inaction*. Somerville: Stockholm Environment Institute-US Center.

Cable News Network International. (2020, April 29). *CNN interview with P.M. Mottley by Christiane Amanpour*. Retrieved from Cable News Network International: <https://www.youtube.com/watch?v=awL3tKAFiU8>

Caribbean Catastrophe Risk Insurance Facility. (2017). *CCRIF SPC Annual Report 2016-2017*. Retrieved from Caribbean Catastrophe Risk Insurance Facility Website: <https://www.ccrif.org/en/publications/annual-report/ccrif-spc-annual-report-2016-2017>

Caribbean Catastrophe Risk Insurance Facility. (2018). *CCRIF SPC Annual Report 2017-2018*. Retrieved from Caribbean Catastrophe Risk Insurance Facility Website: <https://www.ccrif.org/en/publications/annual-report/ccrif-spc-annual-report-2017-2018>

Caribbean Catastrophe Risk Insurance Facility. (2019). *CCRIF SPC Annual Report 2018-2019*. Grand Cayman: CCRIF. Retrieved from <https://www.ccrif.org/publications/annual-report/ccrif-spc-annual-report-2019-20>

Caribbean Catastrophe Risk Insurance Facility. (2020). *CCRIF SPC Annual Report 2019-2020*. Grand Cayman: CCRIF. Retrieved from <https://www.ccrif.org/publications/annual-report/ccrif-spc-annual-report-2019-20>

Caribbean Catastrophe Risk Insurance Facility. (2021). *CCRIF Makes First Parametric Insurance Payouts of the 2021 Atlantic Hurricane Season*. Grand Cayman: CCRIF.

Caribbean Catastrophe Risk Insurance Facility. (2021). *CCRIF SPC Annual Report 2020 - 2021*. Grand Cayman: CCRIF. Retrieved from <https://www.ccrif.org/publications/annual-report/ccrif-spc-annual-report-2020-2021>

Caribbean Catastrophe Risk Insurance Facility. (2022). *Homepage*. Retrieved from Caribbean Catastrophe Risk Insurance Facility Website: [https://www.ccrif.org/?language\\_content\\_entity=en](https://www.ccrif.org/?language_content_entity=en)

Caribbean Community Climate Change Centre. (2009). *Climate Change and the Caribbean: A Regional Framework for achieving development resilient to Climate Change (2009-2015)*. Belmopan: Caribbean Community Climate Change Centre.

Caribbean Community, Caribbean Disaster Emergency Management Agency, World Food Programme , & Food and Drug Administration. (2022). *Caribbean Food Security & Livelihoods Survey: Impacts of COVID-19 and the Cost of Living Crisis - Regional Summary Report*. World Food Programme.

Caribbean Development Bank . (2019, December 12). *CDB supports South Coast Sewerage System Solution for Barbados*. Retrieved from Caribbean Development Bank Website: <https://www.caribank.org/newsroom/news-and-events/cdb-supports-south-coast-sewerage-system-solution-barbados>

Caribbean Development Bank. (2016). *The Changing Nature of Poverty and Inequality in the Caribbean: New Issues, New Solutions*. Bridgetown: CDB.

Caribbean Development Bank. (2018). *Financing the Blue Economy: A Caribbean Development Opportunity*.

Caribbean Disaster Emergency Management Agency. (2014). *Regional Comprehensive Disaster Management (CDM) Strategy & Results Framework (2014- 2024)*. Lodge Hill: Caribbean Disaster Emergency Management Agency.

Caribbean Disaster Emergency Management Agency. (2014). *Regional Comprehensive Disaster Management (CDM) Strategy and Programming Framework 2014-2024*. Barbados: Caribbean Disaster Emergency Management Agency.

Caribbean Disaster Emergency Management Agency. (2016, July 19). *CDEMA Home Page*. Retrieved from The Caribbean Disaster Emergency Management Agency Website: [http://www.cdema.org/index.php?option=com\\_content&view=article&id=337&Itemid=156](http://www.cdema.org/index.php?option=com_content&view=article&id=337&Itemid=156)

Caribbean Disaster Emergency Management Agency, Department of Emergency Management. (2021). *Multi-Hazard Early Warning Systems Gap Analysis Report - Barbados*. Lower Estate : Caribbean Disaster Emergency Management Agency.

Caribbean Disaster Emergency Management Agency, Department of Emergency Management. (2022). *The Multi-Hazard Early Warning Systems Roadmap and Action Plan: Barbados (2021-2024)*. CDEMA.

CARICOM Community. (2016, June 24). *Inaction on Climate Change could lead to enormous costs for the Caribbean*. Retrieved from CARICOM Community Website: <https://caricom.org/inaction-on-climate-change-could-lead-to-enormous-costs-for-the-caribbean/>

Caricom Today. (2020, 10 20). *Potential Oil Spill Threatens Caribbean Sea*. Retrieved from Caricom Today Website: <https://today.caricom.org/2020/10/20/potential-oil-spill-threatens-caribbean-sea/>

Carter, S., & Singh, A. (2010). *Barbados National Environmental Summary*. Bridgetown: Government of Barbados.

Centers for Disease Control and Prevention. (2012). *Identifying Vulnerable Older Adults and Legal Options for Increasing their Protection During All-Hazards Emergencies: A Cross-Sector Guide for States and Communities*. Atlanta: Centers for Disease Control and Prevention.

Chapman, S. C., Chakraborty, S., Dreccer, M. F., & Howden, S. M. (2012). Plant Adaptation to Climate Change: Opportunities and Priorities in breeding. *Crop Pastures Science*(63), 251-268.

Climate & Development Knowledge Network (CDKN). (2014). *The IPCC's Fifth Assessment Report. What's in it for Small Island Developing States?* Retrieved from <https://cdkn.org/story/report-ipccs-fifth-assessment-report-whats-in-it-for-small-island-developing-states>

Climate Studies Group Mona. (2020). *The State of the Caribbean Climate: Produced for the Caribbean Development Bank*.

Coastal Zone Management Unit. (2022). *Homepage*. Retrieved from Coastal Zone Management Unit Website: <http://www.coastal.gov.bb>

Crowards, T. (2005). Comparative Susceptibility to Natural Disasters in the Caribbean. In D. Pantin, *The Caribbean Economy: A Reader* (pp. 677-694). Kingston: Ian Randle Publishing Limited.

Degg, & Martin. (n.d.). *Natural Disasters: Recent trends and Future prospects*.

Department of Emergency Management. (2019). *The Barbados Comprehensive Disaster Management (CDM) Country Work Programme (CWP) 2019-2023*. Bridgetown : Government of Barbados .

Department of Emergency Management. (2019). *Strategic Plan (2019-2023)*. Bridgetown: Government of Barbados.

Department of Emergency Management. (2020). *Annual Report*. Government of Barbados .

Department of Emergency Management. (2021). *Annual Report: Final Draft*. Government of Barbados.

Department of Emergency Management. (2022). *Emergency Shelters*. Bridgetown : Government of Barbados.

EM-DAT | The international disasters database. (2022). *Custom Request for types of hazards affecting Barbados*. Retrieved from EM-DAT | The international disasters database: <https://emdat.be/>

European Commission. (2022). *INFORM Risk Index 2023*. Retrieved from DRMKC - INFORM: <https://drmkc.jrc.ec.europa.eu/inform-index>

European Union. (2022). *INFORM Annual Report 2022*. Luxembourg: Luxembourg: Publications Office of the European Union.

FAO. (2016). *FAO Water Reports: Drought characteristics and management in the Caribbean*. Rome: FAO.

Farrell, D., Trotman, A., & Cox, C. (2010). *Global Assessment Report on Disaster Risk Reduction*. Drought early warning and risk reduction- A case study of the Caribbean Drought of 2009-2010. International Strategy for Drought Reduction (ISDR).

Flanagan, B., Gregory, E., Hallisay, E., Heitgerd, J., & Lewis, B. (2001). A Social Vulnerability Index for Disaster Management. *Journal of Homeland Security and Emergency Management*, 8(1). doi:10.2202/1547-7355.1792

GIZ. (2019). *Guidance Note: Coherence Concepts and Practices*. Global Initiative on Disaster Risk Management, Regional Consultative Committee on Disaster Management (RCC). *14th Regional Consultative Committee Meeting on Disaster Risk Management* (pp. 1-29). Kathmandu: Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ). Retrieved from [https://www.preventionweb.net/files/74801\\_tt.pdf](https://www.preventionweb.net/files/74801_tt.pdf)

Global Private Sector Alliance for Disaster Resilient Societies: (ARISE) Initiative. (2022, September 10). *ARISE Initiative*. Retrieved from Global Private Sector Alliance for Disaster Resilient Societies: <https://www.ariseglobalnetwork.org/>

Government of Barbados. (2015). Barbados National Report for the Third United Nations Conference on Housing and Sustainable Urban Development: HABITAT III. *Third United Nations Conference on Housing and Sustainable Urban Development* (p. 112). Bridgetown: Ministry of Housing and Lands.

Government of Barbados. (1998). *Physical Development Plan of Barbados*. Bridgetown: Government of Barbados.

Government of Barbados. (2003). *Physical Development Plan of Barbados*. Bridgetown: Government of Barbados.

Government of Barbados. (2004). *National Sustainable Development Policy for Barbados*. Bridgetown: Ministry of Housing, Lands and the Environment (Environment), Government of Barbados.

Government of Barbados. (2005). *The National Strategic Action Plan of Barbados 2005-2025*. Bridgetown: Research and Planning Unit - Economic Affairs Division, Ministry of Finance and Economic Affairs.

Government of Barbados. (2009). *The Barbados Estimates (Approved) 2009-2010*. Bridgetown: Government Printing Department.

Government of Barbados. (2010). *Barbados National Assessment Report*. Bridgetown: The Ministry of Environment, Water Resources and Drainage.

Government of Barbados. (2010). *The Barbados Estimates (Approved) 2010-2011*. Bridgetown: Government Printing Department.

Government of Barbados. (2011). *The Barbados Estimates (Approved) 2011-2012*. Bridgetown: Government Printing Department.

Government of Barbados. (2012). *The Barbados Estimates (Approved) 2012-2013*. Bridgetown: Government Printing Department.

Government of Barbados. (2013). *The Barbados Estimates (Approved) 2013-2014*. Bridgetown: Government Printing Department.

Government of Barbados. (2013). *The Barbados Medium Term Growth and Development Strategy (2013 – 2020): Recovery, Adjustment and Sustainable Development*. Bridgetown: Government of Barbados. Retrieved from <https://caribbean.eclac.org/publications/barbados-growth-and-development-strategy-2013-2020>

Government of Barbados. (2014). *Country Document for Disaster Risk Reduction: Barbados*. Department of Emergency Management.

Government of Barbados. (2014). *The Barbados Estimates (Approved) 2014-2015*. Bridgetown: Government Printing Department.

Government of Barbados. (2015). *Barbados Intended Nationally Determined Contribution*. Communication to the UNFCCC (pp. 1-9). Bridgetown: Government of Barbados.

Government of Barbados. (2015). *Report of the Chief Medical Officer 2010-2012*. Bridgetown: The Planning and Research Unit.

Government of Barbados. (2015). *The Barbados Estimates (Approved) 2015-2016*. Bridgetown: Government Printing Department.

Government of Barbados. (2016). *The Barbados Economic and Social Report*. Bridgetown: Government of Barbados.

Government of Barbados. (2016). *The Barbados Estimates (Draft) 2016-2017*. Bridgetown: Government Printing Department.

Government of Barbados. (2016). *The Barbados Survey of Living Conditions*. Bridgetown: Government of Barbados.

Government of Barbados. (2017). *Barbados National Energy Policy (BNEP) (2017-2037)*. Bridgetown: Division of Energy and Telecommunications, Prime Minister's Office.

Government of Barbados. (2017, November 19). *Department of Emergency Management: Home*. Retrieved from Government of Barbados: Department of Emergency Management: <http://www.dem.gov.bb/>

Government of Barbados. (2017). *The Barbados Estimates (Approved) 2017-2018*. Bridgetown: Government Printing Department.

Government of Barbados. (2018). *The Barbados Estimates (Approved) 2018-2019*. Bridgetown: Government Printing Department.

Government of Barbados. (2018). *The Barbados' Second National Communications to the UNFCCC*. Bridgetown: Government of Barbados.

Government of Barbados. (2019). *The Barbados Estimates (Approved) 2019-2020*. Bridgetown: Government Printing Department.

Government of Barbados. (2021). *Barbados' 2021 Update on the First Nationally Determined Contributions to the UNFCCC*. Bridgetown: Government Printing Department.

Government of Barbados. (2021). *Physical Development Plan of Barbados*. Bridgetown: Government of Barbados.

Government of Barbados. (2021). *The Barbados Estimates (Approved) 2020-2021*. Bridgetown: Government Printing Department.

Government of Barbados. (2021). *The Barbados Estimates (Approved) 2021-2022*. Bridgetown: Government Printing Department.

Government of Barbados. (2022, September 1). *Estimates*. Retrieved from The Barbados Parliament: <https://www.barbadosparliament.com/document/listall/3>

Government of Barbados. (2022). *The Barbados Comprehensive Disaster Management (CDM) Policy*. Bridgetown: Government of Barbados.

Government of Barbados. (2022). *The Barbados Estimates (Approved) 2022-2023*. Bridgetown: Government Printing Department.

Griffin, G. (2007). Atmospheric Movement of Microorganisms in Clouds of Desert Dust and Implications for Human Health. *Clinical Microbiology Reviews*, 20(3), 459–477. doi:10.1128/CMR.00039-06

Guyana: Department of Public Information. (2022, May 20). *Guyana/Barbados food terminal critical to reducing region's food import bill – PM Mottley*. Retrieved from Guyana: Department of Public Information Website: <https://dpi.gov.gy/guyana-barbados-food-terminal-critical-to-reducing-regions-food-import-bill-pm-mottley/>

Henry, B., Charmley, E., Eckard, R., Gaughan, J. B., & Hegarty, R. (2012). Livestock Production in a Changing Climate: Adaptation and Mitigation Research in Australia. *Crop Pasture Science*(63), 191-202.

Hincks, T., Sparks, S., Dunkley, P., & Cole, P. (2021). *Volcanic Hazards Atlas of the Lesser Antilles: Montserrat*. UWI Seismic Research Centre. Retrieved from <https://uwiseismic.com/wp-content/uploads/2021/10/Montserrat.pdf>

Industry Week. (2010). *Maplecroft's 2010 Water Security Risk Index Identifies Ten Countries at Extreme Risk*. Retrieved from Industry Week Website : <https://www.industryweek.com/finance/article/22010379/maplecrofts-2010-water-security-risk-index-identifies-ten-countries-at-extreme-risk>

Inter-American Development Bank. (October 2020). *Index of Governance and Public Policy in Disaster Risk Management (iGOPP): National Report Barbados*. Environment, Rural Development and Risk Management Division.

Inter-American Development Bank, Sistemas Integrales. (2017). *Barbados Statistical Service-Inter-American Development Bank: Barbados Survey of Living Conditions 2016 - Methodological Report*. Inter-American Development Bank .

Inter-American Development Bank: Environment, Rural Development and Disaster Risk Division (INE/RND). (2010). *Indicators of Disaster Risk and Risk Management: Programme of Latin America and the Caribbean - Barbados*. Inter-American Development Bank.

Intergovernmental Panel on Climate Change. (2013). *Climate Change 2013: The Physical Science Basis. Contribution of Working Group I to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change*. In [ T.F., D. Qin, G.-K. Plattner, M. Tignor, S. Allen, J. Boschung, . . . P. M. (eds.)], *Climate Phenomena and their relevance to future Regional Climate Change* (pp. 1200-1221 pp). Cambridge, United Kingdom and New York, NY, USA,: Cambridge University Press.

Intergovernmental Panel on Climate Change. (2021). *Climate Change 2021: The Physical Science Basis. Contribution of Working Group I. Summary for Policymakers*. doi:10.1017/9781009157896.001.

Intergovernmental Panel on Climate Change. (2022). IPCC Sixth Assessment Report: Working Group I – Physical Science Basis. *Regional Fact sheet - Ocean*. Retrieved from [https://www.ipcc.ch/report/ar6/wg1/downloads/factsheets/IPCC\\_AR6\\_WGI\\_Regional\\_Fact\\_Sheet\\_Ocean.pdf](https://www.ipcc.ch/report/ar6/wg1/downloads/factsheets/IPCC_AR6_WGI_Regional_Fact_Sheet_Ocean.pdf)

Intergovernmental Panel on Climate Change. (2022). IPCC Sixth Assessment Report: Working Group I – The Physical Science Basis. *Regional Fact Sheet - Small Islands*, pp. 1-2. Retrieved from [https://www.ipcc.ch/report/ar6/wg1/downloads/factsheets/IPCC\\_AR6\\_WGI\\_Regional\\_Fact\\_Sheet\\_Small\\_Islands.pdf](https://www.ipcc.ch/report/ar6/wg1/downloads/factsheets/IPCC_AR6_WGI_Regional_Fact_Sheet_Small_Islands.pdf)

Intergovernmental Panel on Climate Change. (2022). IPCC Sixth Assessment Report: Working Group II – Impacts, Adaptation and Vulnerability. *Fact sheet - Human Settlements: Climate Change Impacts and Risks*, pp. 1-3. Retrieved from [https://www.ipcc.ch/report/ar6/wg2/downloads/outreach/IPCC\\_AR6\\_WGII\\_FactSheet\\_HumanSettlements.pdf](https://www.ipcc.ch/report/ar6/wg2/downloads/outreach/IPCC_AR6_WGII_FactSheet_HumanSettlements.pdf)

Intergovernmental Panel on Climate Change. (2022). IPCC Sixth Assessment Report: Working Group II – Impacts, Adaptation and Vulnerability. *Fact sheet - Responding to Sea Level Rise: Climate Change Impacts and Risks*, pp. 1-2. Retrieved from [https://www.ipcc.ch/report/ar6/wg2/downloads/outreach/IPCC\\_AR6\\_WGII\\_FactSheet\\_SLR.pdf](https://www.ipcc.ch/report/ar6/wg2/downloads/outreach/IPCC_AR6_WGII_FactSheet_SLR.pdf)

Intergovernmental Panel on Climate Change. (2022). IPCC Sixth Assessment Report: Working Group II – Impacts, Adaptation and Vulnerability. *Fact sheet - Small Islands: Climate Change Impacts and Risks*, pp. 1-2. Retrieved from [https://www.ipcc.ch/report/ar6/wg2/downloads/outreach/IPCC\\_AR6\\_WGII\\_FactSheet\\_SmallIslands.pdf](https://www.ipcc.ch/report/ar6/wg2/downloads/outreach/IPCC_AR6_WGII_FactSheet_SmallIslands.pdf)

Intergovernmental Panel on Climate Change. (2022). IPCC Sixth Assessment Report: Working Group II – Impacts, Adaptation and Vulnerability. *Fact sheet - Biodiversity: Climate Change Impacts and Risks*, pp. 1-3. Retrieved from [https://www.ipcc.ch/report/ar6/wg2/downloads/outreach/IPCC\\_AR6\\_WGII\\_FactSheet\\_Biodiversity.pdf](https://www.ipcc.ch/report/ar6/wg2/downloads/outreach/IPCC_AR6_WGII_FactSheet_Biodiversity.pdf)

International Labour Organisation. (2005). *The ILO Poverty Manual*. ILO.

International Tsunami Information Center. (2022). *Country Profile - Barbados*. Retrieved from International Tsunami Information Center Website: [http://itic.ioc-unesco.org/index.php?option=com\\_content&view=category&id=2678&Itemid=3059](http://itic.ioc-unesco.org/index.php?option=com_content&view=category&id=2678&Itemid=3059)

Loop News. (2020, January 3). *Barbados has 'sick' buildings "from Parliament to schools"*. Retrieved from Loop News Website: <https://barbados.loopnews.com/content/barbados-has-sick-buildings-parliament-schools#:~:text=A%20lack%20of%20maintenance%20is,nation%20for%20this%20new%20decade>.

Loop News. (2021). *5.3 Magnitude Earthquake off Barbados felt in parts of Trinidad, Grenada*. Retrieved from Loop News Website: <https://barbados.loopnews.com/content/53-earthquake-barbados-felt-parts-trinidad-grenada>

Loop News. (2021, July 3). *Improving Barbados' housing infrastructure a priority*. Retrieved from Loop News Website: <https://barbados.loopnews.com/content/improving-barbados-housing-infrastructure-priority>

Loop News. (2022, June 24). *Development of Early Warning Policy in advanced stage*. Retrieved from Loop News Website: <https://barbados.loopnews.com/content/development-early-warning-policy-advance-stage>

MOVE - Movilidad Eléctrica en Latinoamérica. (2021, January 21). *Electric buses implementation in Barbados*. Retrieved from Youtube: <https://www.youtube.com/watch?v=VFXG8Odfq-Y>

Mulder, N. (2020). *The impact of the COVID-19 pandemic on the tourism sector in Latin America and the Caribbean, and options for a sustainable and resilient recovery*. United Nations Economic Commission for Latin America and the Caribbean. Retrieved from <http://hdl.handle.net/11362/46502>

Nation News. (2019, August 13). *Update: Fire at Recycling Plant*. Retrieved from Nation News Website: <https://www.nationnews.com/2019/08/13/update-fire-at-recycling-business/>

National Geographic. (2020, April 17). *Ten years later, BP oil spill continues to harm wildlife—especially dolphins*. Retrieved from National Geographic Website: <https://www.nationalgeographic.com/animals/article/how-is-wildlife-doing-now--ten-years-after-the-deepwater-horizon>

NationNews. (2022, December 15). *Disruption of services continue at QEH*. Retrieved from NationNews Website: <https://www.nationnews.com/2022/12/15/disruption-services-continue-qeh/>

NationNews. (2021, July 6). *Duguid: Hurricane Strapit to save roofs*. Retrieved from NationNews Website: <https://www.nationnews.com/2021/07/06/duguid-hurricane-strapit-save-roofs/>

NationNews. (2022, July 13). *Call for tougher laws to fight elder abuse*. Retrieved from Nation News Website: <https://www.nationnews.com/2022/06/13/call-tougher-laws-fight-elder-abuse/>

NationNews. (2022, March 11). *Government boosting IT system after breach*. Retrieved from NationNews Website: <https://www.nationnews.com/2022/03/11/government-boosting-system-breach/>

NationNews. (2022, 12 14). *Possible delays at QEH due to internet issues*. Retrieved from NationNews Website: [https://www.nationnews.com/2022/12/14/qeh-changes-due-internet-issues/?fbclid=IwAR0-RoQNYLny\\_DG2CSQKe9PwgeN0P0-bclSFHUQpR62KZU\\_6V8Vvs\\_q0xEE](https://www.nationnews.com/2022/12/14/qeh-changes-due-internet-issues/?fbclid=IwAR0-RoQNYLny_DG2CSQKe9PwgeN0P0-bclSFHUQpR62KZU_6V8Vvs_q0xEE)

Oppenheimer, M., Glavovic, B. C., Hinkel, J., van de Wal, R., Magnan, A. K., Abd-Elgawad, A., . . . Sebesvari, Z. (2019). *Sea Level Rise and Implications*. In H. -O. Pörtner, D. C. Roberts, V. Masson-Delmotte, P. Zhai, M. Tignor, E. Poloczanska, . . . N. M. Weyer, *IPCC Special Report on the Ocean and Cryosphere in a Changing Climate* (pp. 321-445). Cambridge, UK and New York, NY, USA: Cambridge University Press,. doi: <https://doi.org/10.1017/9781009157964.006>

Pan American Health Organization. (2018). *Climate Change and Health in Small Island Developing States: A WHO Special Initiative in collaboration with UNFCCC and the Fijian Presidency of COP-23 - SIDS in the Caribbean Region*. Washington, D.C: PAHO.

Pan American Health Organization. (2020, August 26). *Barbados – An example of government leadership and regional cooperation in containing the COVID-19 virus*. Retrieved from Pan American Health Organization Website: <https://www.paho.org/en/documents/barbados-example-government-leadership-and-regional-cooperation-containing-covid-19-virus>

Pan American Health Organization. (2020, February 4). PWR-ECC Presents Credentials to Minister of Foreign Affairs in Barbados. Retrieved from Pan American Health Organization Website: [https://www3.paho.org/ecc/index.php?option=com\\_content&view=article&id=716:pwr-ecc-presents-credentials-to-minister-of-foreign-affairs-in-barbados&Itemid=332](https://www3.paho.org/ecc/index.php?option=com_content&view=article&id=716:pwr-ecc-presents-credentials-to-minister-of-foreign-affairs-in-barbados&Itemid=332)

Pan American Health Organization. (2021, August 4). Barbados receives its third batch of COVID-19 vaccines through the COVAX Facility. Retrieved from Pan American Health Organization Website: <https://www.paho.org/en/news/24-8-2021-barbados-receives-its-third-batch-covid-19-vaccines-through-covax-facility>

Pan American Health Organization. (2021, September 9). Hospitals and isolation facilities in the Eastern Caribbean Countries are overwhelmed with the increase of Covid-19 cases combined by shortage of health workforce and clinical supplies. Retrieved from Pan American Health Organization Website: <https://www.paho.org/en/news/27-9-2021-hospitals-and-isolation-facilities-eastern-caribbean-countries-are-overwhelmed>

Pan American Health Organization. (2021). PAHO prepares Barbados for COVID-19 testing. Retrieved from Pan American Health Organization Website: <https://www.paho.org/en/stories/paho-prepares-barbados-covid-19-testing>

Pan American Health Organization. (2022, May 5). PAHO receives Humanitarian Award from Barbados for its support during the COVID-19 pandemic. Retrieved from Pan American Health Organization Website: <https://www.paho.org/en/news/5-5-2022-paho-receives-humanitarian-award-barbados-its-support-during-covid-19-pandemic>

Pan American Health Organization. (2022). PAHO: Barbados and the Eastern Caribbean Countries. Retrieved from Pan American Health Organization Website: <https://www.paho.org/en/barbados-and-eastern-caribbean-countries>

Pantin, D. (1989). *Into The Valley of Debt: An Alternative Road to the IMF/World Bank Path* (1st ed.). Port of Spain: Gloria V. Ferguson.

Pantin, D. (2005). *Are Small Island Developing States more vulnerable to natural disasters? Implications for Sustainable Development in the Caribbean*. In D. Pantin, *The Caribbean Economy: A Reader* (pp. 665-676). Kingston: Ian Randle Publishing Limited .

Pantin, D. (2005). *The Caribbean Economy: A Reader*. Kingston: Ian Randle Publishing Limited .

Rojas-Downing, M. M., Nejadhashem, A. P., Harrigan, T., & Woznicki, S. A. (2017). Climate Change and Livestock: Impacts, Adaptation and Mitigation. *Climate Risk Management*(16), 145-163.

Sakhamuri, S., & Cummings, S. (2019). Increasing trans-Atlantic intrusion of Sahara dust: A cause of concern? *Elsevier*, 1-2.

Silva, H. (2015). *Climate Change and Public Health*. Presentation at the University of Technology, Kingston, Jamaica.

Sustainable Energy for All. (2014). *Barbados Rapid Assessment Gap Analysis*. Retrieved from [http://www.se4all.org/wp-content/uploads/2014/01/Barbados-Rapid-Assessment\\_gap-analysis-DET-PMO.pdf](http://www.se4all.org/wp-content/uploads/2014/01/Barbados-Rapid-Assessment_gap-analysis-DET-PMO.pdf)

Tanner, T., & Allouche, J. (2011). Towards a New Political Economy of Climate Change and Development. *IDS Bulletin*, 42(3), 1-14.

Tanner, T., & Horn-Phathanothai, L. (2014). *Climate Change and Development*. Oxon: Routledge.

The Barbados Meteorological Services. (2022). *Climate Data* . Retrieved from The Barbados Meteorological Services Website : <https://www.barbadosweather.org/>

The Global Economy. (2022). 2019 *Rankings: Road Quality*. Retrieved from The Global Economy Website: [https://www.theglobaleconomy.com/rankings/roads\\_quality/](https://www.theglobaleconomy.com/rankings/roads_quality/)

The Government of Barbados. (2014). *The Barbados Tourism Master Plan (2014-2023) - Report I: The Master Plan*. Bridgetown: Ministry of Tourism and International Transport. Retrieved from [https://www.greengrowthknowledge.org/sites/default/files/downloads/policy-database/BARBADOS\)%20Barbados%20Tourism%20Master%20Plan%202014-2023%20Report%20I.%20The%20Master%20Plan.pdf](https://www.greengrowthknowledge.org/sites/default/files/downloads/policy-database/BARBADOS)%20Barbados%20Tourism%20Master%20Plan%202014-2023%20Report%20I.%20The%20Master%20Plan.pdf)

The University of the West Indies; Government of Barbados; United Nations Development Programme. (2018). *The Barbados Blue Economy Scoping Study: Stocktake and Diagnostic Analysis*. UNDP.

The Washington Post. (2020, July 16). *Barbados wants you to work from its beaches during the pandemic*. Retrieved July 21, 2022, from [www.washingtonpost.com/world/2020/07/16/barbados-work-remote-coronavirus](http://www.washingtonpost.com/world/2020/07/16/barbados-work-remote-coronavirus).

Thornton, P. K., Van de Steeg, J., Notenbaert, A., & Herrero, M. (2009). The Impacts of Climate Change on Livestock and Livestock Systems in Developing Countries: A Review of What we Know and What we Need to Know. *Agricultural Systems*, 113-127.

UNECLAC. (2011). *Caribbean Development Volume 3: The Economics of Climate Change in the Caribbean*. ECLAC, Subregional Headquarters for the Caribbean. Retrieved from <https://www.cepal.org/en/publications/38620-economics-climate-change-caribbean>

UNECLAC. (2011). *The Economics of Climate Change in the Caribbean*. Port of Spain: UNECLAC.

UNECLAC, UNDRR. (2021). *The coronavirus disease (COVID-19) pandemic: an opportunity for a systemic approach to disaster risk for the Caribbean: COVID-19 Report*. NU. CEPAL-UNDRR. Retrieved from <http://hdl.handle.net/11362/46732>

UNISDR. (2014). *Sendai Framework for Disaster Risk Reduction 2015-2030*. Geneva: United Nations Office on Disaster Risk Reduction.

United Nations. (2022). Sustainable Development: Disaster Risk Reduction. *Seventy-sixth session of the United Nations General Assembly*, (pp. 1-12).

United Nations Children's Fund. (2019). *A Situational Analysis of Children in the Eastern Caribbean*. Bridgetown: UNICEF Eastern Caribbean. Retrieved from <https://www.unicef.org/easterncaribbean/reports/situation-analysis-children-eastern-caribbean-area>

United Nations Climate Change. (2022). *Cooperation Implementation*. Retrieved from United Nations Climate Change Website: <https://unfccc.int/process/the-paris-agreement/cooperative-implementation#:~:text=Article%206%20of%20the%20Paris,sustainable%20development%20and%20environmental%20integrity>.

United Nations Conference on Environment and Development. (1992). *The Rio Declaration on Environment and Development - Annex 1*. Rio de Janeiro: UNCED. doi:A/CONF.151/26

United Nations Department for Economic and Social Affairs. (2015). *Population Division Report on World Population Ageing*. UNDESA.

United Nations Department of Economic and Social Affairs. (2010). *Trends in Small Island Developing States*. New York: United Nations Department of Economic and Social Affairs: Division of Sustainable Development.

United Nations Department of Economic and Social Affairs. (2013a). *World Population Prospects: The 2012 Revision*. New York: United Nations Department of Economic and Social Affairs.

United Nations Development Programme. (2004). *A Global Report: Reducing Disaster Risk - A Challenge for Development*. New York: Bureau for Crisis Prevention and Recovery.

United Nations Development Programme. (2018). *Statistical Update: Human Development Indicators and Indices*. New York: United Nations Development Programme.

United Nations Development Programme. (2022). *Human Development Report 2021-2022: Uncertain Times, Unsettled Lives: Shaping our Future in a Transforming World*. New York: United Nations Development Programme.

United Nations Development Programme, United Nations Children Fund, United Nations Entity for Gender Equality and the Empowerment of Women (Eastern Caribbean). (2020, December). *COVID-19 Heat Series: Barbados COVID-19 HEAT Report - Human and Economic Assessment of Impact*.

United Nations Economic Commission for Latin America and the Caribbean. (2008). *Agriculture, rural development, land, drought and desertification: obstacles, lessons and challenges for the sustainable development of Latin America and the Caribbean*. United Nations Economic Commission for Latin America and the Caribbean.

United Nations Educational, Scientific and Cultural Organization. (1993). *The World Heritage Convention: Tentative Lists*. Retrieved from UNESCO Website: <https://whc.unesco.org/en/tentativelists/1993/#:~:text=Coordinates%3A%20Barbados%20is%20located%20at,in%20its%20east%2Dcentral%20part>

United Nations Educational, Scientific and Cultural Organization. (2022). *Country Profile of Barbados*. Retrieved from UNESCO Institute of Statistics: <http://uis.unesco.org/en/country/bb>

United Nations Educational, Scientific and Cultural Organization. (2022). *Intergovernmental Oceanographic Commission*. Retrieved from UNESCO Website : <https://www.ctic.ioc-unesco.org/>

United Nations Educational, Scientific and Cultural Organization. (2022). *Intergovernmental Oceanographic Commission: CARIBE WAVE/CARIBE WAVE LANTEX Exercises*. Retrieved from UNESCO Website : <https://www.ctic.ioc-unesco.org/caribe-wave-caribe-wave-lantex-exercises>

United Nations Environment Programme . (2011). *Towards a Green Economy*.. In P. Rode, R. Burdett, & J. C. Soares, *Buildings: Investing in Energy and Resource Efficiency* (p. 354). Geneva: United Nations Environmental Programme.

United Nations Environment Programme. (2010). *The State of Biodiversity in Latin America and the Caribbean*. Nairobi: UNEP.

United Nations Environment Programme. (2014). *Emerging Issues for Small Island Developing States: Results of the UNEP Foresight Process*. Nairobi: United Nations Environment Programme.

United Nations Environment Programme. (2014). *Global Environment Outlook, Small Island Developing States*. Nairobi: United Nations Development Programme.

United Nations Framework Convention on Climate Change. (2015). *Adoption of the Paris Agreement*. (pp. 1-31). Paris: The United Nations Framework Convention on Climate Change.

United Nations Framework Convention on Climate Change. (2015). *Synthesis Report on The Aggregate Effect Of Intended Nationally Determined Contributions (INDCS)*. Bonn: UNFCCC.

United Nations General Assembly. (1994). *The Barbados Programme of Action*. Bridgetown: United Nations Division for Sustainable Development .

United Nations National Accounts Database. (2022). *Homepage*. Retrieved from United Nations National Accounts Database Website: <https://unstats.un.org/unsd/snaama>

United Nations Office for Disaster Risk Reduction. (2022, September 12). *The Caribbean consolidates its partnership for advancing Multi-Hazard Early Warning Systems in the region*. Retrieved from United Nations Office for Disaster Risk Reduction Website: <https://www.undrr.org/news/caribbean-consolidates-its-partnership-advancing-multi-hazard-early-warning-systems-region>

United Nations Office for Disaster Risk Reduction. (2015). *Global Assessment Report on Disaster Risk Reduction*. France: United Nations.

United Nations Office for Disaster Risk Reduction. (2020). *Disaster Risk Reduction and the Caribbean Private Sector: The role of the telecommunications sector in the context of COVID-19*. United Nations Office for Disaster Risk Reduction.

United Nations Office for Disaster Risk Reduction. (2020). *Hazard Definition & Classification Review - Technical Report*. Geneva: United Nations Office for Disaster Risk Reduction.

United Nations Office for Disaster Risk Reduction. (2022, November 7). *A world with zero climate disasters needs early warnings for all*. Retrieved from United Nations Office for Disaster Risk Reduction Website: <https://www.undrr.org/news/world-zero-climate-disasters-needs-early-warnings-all>

United Nations Office for Disaster Risk Reduction. (2022, July 19). *Terminology: Early Warning System*. Retrieved from United Nations Office for Disaster Risk Reduction Website: <https://www.undrr.org/terminology/early-warning-system#:~:text=Annotations%3A%20Effective%20%E2%80%99>

United Nations Office for Disaster Risk Reduction. (2022, October 12). *The Caribbean is at the forefront of early warning systems*. Retrieved from United Nations Office for Disaster Risk Reduction Website: <https://www.undrr.org/news/caribbean-forefront-early-warning-systems>

United Nations Office for Disaster Risk Reduction. (2022). *UNDRR Terminology*. Retrieved from United Nations Office for Disaster Risk Reduction: <https://www.undrr.org/terminology/vulnerability>

United Nations Office for Disaster Risk Reduction for the Americas and the Caribbean (UNDRR - ROAMC). (2019). *ROAMC Partnerships Annual Report: Private Sector Activities*. UNDRR. Retrieved from <https://reliefweb.int/report/barbados/roamc-partnerships-annual-report-private-sector-activities-2019>

United Nations Office for Drugs and Crime. (2022). *Country List: Barbados*. Retrieved from United Nations Office for Drugs and Crime Website: <https://dataunodc.un.org/content/country-list>

United Nations Office of the High Representative for the Least Developed Countries, Landlocked Developing Countries and Small Island Developing States. (2015). *Small Island Developing States in Numbers. Climate Change Edition 2015*, pp. 1-44.

United Nations Office of the High Representative for the Least Developed Countries, Landlocked Developing Countries and Small Island Developing States. (2005). *Mauritius Strategy for the Further Implementation of the Programme of Action for the Sustainable Development of Small Island Developing States*. New York: Office of the High Representative for the Least Developed Countries, Landlocked Developing Countries and Small Island Developing States.

United Nations Office on Drugs and Crime. (2022). *Country Profile: Barbados*. Retrieved from United Nations Office on Drugs and Crime Website: <https://dataunodc.un.org/content/country-list>

University of the West Indies. (2022). *Seismic Research Centre*. Retrieved from The University of the West Indies: <https://uwiseismic.com/>

University of the West Indies: Seismic Research Centre. (2022). *Caribbean Tsunamis*. Retrieved from UWI Seismic Research Centre Website: <https://uwiseismic.com/tsunamis/caribbean-tsunamis/>

University of the West Indies: Seismic Research Centre. (2022). *Earthquake Monitoring*. Retrieved from University of the West Indies: Seismic Research Centre Website: <https://uwiseismic.com/earthquakes/earthquake-monitoring/>

University of the West Indies: Seismic Research Centre. (2022). *Hazard Maps*. Retrieved from UWI: Seismic Research Centre: <https://uwiseismic.com/downloads/seismic-hazard-map/>

University of the West Indies: Seismic Research Centre. (2022). *Interactive Map*. Retrieved from UWI: Seismic Research Centre Website: <https://map.uwiseismic.com/index.php#%7B%22location%22:%22map%22,%22layers%22:%22EQ%22%7D>

University of the West Indies: Seismic Research Centre. (2022). *Island Profiles – Barbados*. Retrieved from UWI Seismic Research Centre Website: <https://uwiseismic.com/island-profiles/barbados/>

University of the West Indies: Seismic Research Centre. (2022). *Tsunami Monitoring*. Retrieved from UWI Seismic Research Centre Website: <https://uwiseismic.com/tsunamis/tsunami-monitoring/>

University of the West Indies: Seismic Research Centre. (2022). *Volcano Monitoring*. Retrieved from UWI: Seismic Research Centre Website: <https://uwiseismic.com/volcanoes/volcano-monitoring/>

University of the West Indies: Seismic Research Centre. (2022). *Volcanoes: Kick-'em-Jenny*. Retrieved from UWI Seismic Research Centre Website: <https://uwiseismic.com/volcanoes/kick-em-jenny/>

University of the West Indies: Seismic Research Centre. (2022). *Volcanoes: Kick-'em-Jenny Hazards*. Retrieved from UWI Seismic Research Centre Website: <https://uwiseismic.com/volcanoes/kick-em-jenny/kej-hazards/>

VIPER Group COVID19 Vaccine Tracker Team. (2022). *The Barbados COVID\_19 Tracker*. Retrieved from COVID\_19 Tracker: <https://covid19.trackvaccines.org/country/barbados/>

Wilhite, D. A., & Glantz, M. H. (1985). *Understanding the drought phenomenon: The role of definitions*. Drought Mitigation Center Faculty Publications.

Wisner, B., Blaikie, P., Cannon, T., & Davis, I. (2004). *At Risk: Natural hazards, people's vulnerability, and disasters*. Routledge.

World Bank Group. (2017, December 1). *Barbados Dashboard: Natural Hazards*. Retrieved from Climate Change Knowledge Portal for developing practitioners and Policy makers: [http://sdwebx.worldbank.org/climateportal/countryprofile/home.cfm?page=country\\_profile&CCode=BRB&ThisTab=NaturalHazards](http://sdwebx.worldbank.org/climateportal/countryprofile/home.cfm?page=country_profile&CCode=BRB&ThisTab=NaturalHazards)

World Bank Group. (2018). *Gender Statistics*. Retrieved from The World Bank Open Database: <https://data.worldbank.org/>

World Bank Group. (2021). *Health Nutrition and Population Statistics*. Retrieved from The World Bank Open Database: <https://data.worldbank.org/>

World Bank Group. (2021). *The World Development Indicators*. Retrieved from The World Bank Open Database: <https://data.worldbank.org/>

World Bank Group. (2022). *Climate Change Knowledge Platform: Country Profile - Barbados*. Retrieved from World Bank Group Website: <https://climateknowledgeportal.worldbank.org/country/barbados/vulnerability>

World Commission on Environment and Development. (1987). *Report of the World Commission on Environment and Development: Our Common Future (Brundtland Report)*. Oxford: Oxford University Press.

World Health Organization. (2009). *Country profile of Environmental Burden of Disease: Barbados*. Geneva: Public Health and the Environment.

World Health Organization. (2014). *Quantitative risk assessment of the effects of climate change on selected causes of death, 2030s and 2050s*. Geneva: WHO.

World Health Organization. (2022). *WHO Coronavirus (COVID-19) Dashboard*. Retrieved from World Health Organization.

World Meteorological Organization. (2022, November 7). *Early Warnings for All Action Plan unveiled at COP27*. Retrieved from World Meteorological Organization Website: <https://public.wmo.int/en/media/press-release/early-warnings-all-action-plan-unveiled-cop27>

World Meteorological Organization. (2022, August 23). *Sand and Dust Storms*. Retrieved from World Meteorological Organization: <https://public.wmo.int/en/our-mandate/focus-areas/environment/sand-and-dust-storms>

Worldometer. (2022). *Map of Barbados (Physical)*. Retrieved from Worldometer: <https://www.worldometers.info/maps/barbados-map/>

# APPENDICES

## APPENDIX I: Risk Components

**Table 24: Risk Components - Hazards**

Hazard Category	Hazard Cluster	Hazards identified	Source
Hydro-meteorological	Convective-related	Thunderstorm Lightning (Electrical storm)	<ul style="list-style-type: none"> <li>Country Document for Disaster Risk Reduction: Barbados, 2014 <a href="https://www.preventionweb.net/publication/country-document-disaster-risk-reduction-barbados-2014">https://www.preventionweb.net/publication/country-document-disaster-risk-reduction-barbados-2014</a></li> <li>The Barbados Meteorological Office, 2022. "Climate Data". <a href="https://www.barbadosweather.org/">https://www.barbadosweather.org/</a></li> </ul>
	Flood	Surface water flooding Flash Flooding Coastal flood	<ul style="list-style-type: none"> <li>Country Document for Disaster Risk Reduction: Barbados, 2014 <a href="https://www.preventionweb.net/publication/country-document-disaster-risk-reduction-barbados-2014">https://www.preventionweb.net/publication/country-document-disaster-risk-reduction-barbados-2014</a></li> <li>The Barbados Meteorological Office, 2022. "Climate Data". <a href="https://www.barbadosweather.org/">https://www.barbadosweather.org/</a></li> </ul>
	Lithometeors	Dust storm or Sandstorm Sand haze	<ul style="list-style-type: none"> <li>Griffin, G. (2007). Atmospheric Movement of Microorganisms in Clouds of Desert Dust and Implications for Human Health. <i>Clinical Microbiology Reviews</i>, 20(3), 459–477. doi:10.1128/CMR.00039-06</li> <li>Sakhamuri, S., &amp; Cummings, S. (2019). Increasing trans-Atlantic intrusion of Sahara dust: A cause of concern? <i>Elsevier</i>, 1-2.</li> </ul>
		Polluted air	<ul style="list-style-type: none"> <li>Country Document for Disaster Risk Reduction: Barbados, 2014 <a href="https://www.preventionweb.net/publication/country-document-disaster-risk-reduction-barbados-2014">https://www.preventionweb.net/publication/country-document-disaster-risk-reduction-barbados-2014</a></li> <li>The Barbados' Second National Communication to the UNFCCC (2018) <a href="https://www4.unfccc.int/sites/SubmissionsStaging/NationalReports/Documents/4693851_Barbados-NC2-1-Barbados%20SNC%20FINAL%20April%202018.pdf">https://www4.unfccc.int/sites/SubmissionsStaging/NationalReports/Documents/4693851_Barbados-NC2-1-Barbados%20SNC%20FINAL%20April%202018.pdf</a></li> </ul>
	Marine	Storm surge Storm tides Tsunami Sea water intrusion Ocean acidification	<ul style="list-style-type: none"> <li>Country Document for Disaster Risk Reduction: Barbados, 2014 <a href="https://www.preventionweb.net/publication/country-document-disaster-risk-reduction-barbados-2014">https://www.preventionweb.net/publication/country-document-disaster-risk-reduction-barbados-2014</a></li> <li>The University of the West Indies: Seismic Research Centre "Caribbean Tsunamis". <a href="https://uwiseismic.com/tsunamis/caribbean-tsunamis/">https://uwiseismic.com/tsunamis/caribbean-tsunamis/</a></li> <li>The University of the West Indies: Seismic Research Centre. 2022. Island Profiles – Barbados". <a href="https://uwiseismic.com/island-profiles/barbados/">https://uwiseismic.com/island-profiles/barbados/</a></li> </ul>

Hazard Category	Hazard Cluster	Hazards identified	Source
Hydro-meteorological	Marine	Storm surge Storm tides Tsunami Sea water intrusion Ocean acidification	<ul style="list-style-type: none"> <li>• The University of the West Indies: Seismic Research Centre. 2022. "Tsunami Monitoring". <a href="https://uwiseismic.com/tsunamis/tsunami-monitoring/">https://uwiseismic.com/tsunamis/tsunami-monitoring/</a></li> <li>• Barbados Government Information Service, 2014 "Earthquakes and Tsunamis No Stranger to Barbados". <a href="https://gisbarbados.gov.bb/blog/earthquakes-and-tsunamis-no-stranger-to-barbados/">https://gisbarbados.gov.bb/blog/earthquakes-and-tsunamis-no-stranger-to-barbados/</a></li> <li>• The University of the West Indies: Seismic Research Centre. 2022 'Volcanoes – Kick-'em-Jenny'. <a href="https://uwiseismic.com/volcanoes/kick-em-jenny/">https://uwiseismic.com/volcanoes/kick-em-jenny/</a></li> <li>• The University of the West Indies: Seismic Research Centre. 2022. "Volcanoes: Kick-'em-Jenny Hazards". <a href="https://uwiseismic.com/volcanoes/kick-em-jenny/kej-hazards/">https://uwiseismic.com/volcanoes/kick-em-jenny/kej-hazards/</a></li> <li>• Barbados Government Information Service, 2018. "Kick-'Em-Jenny No Direct Threat to Barbados". <a href="https://gisbarbados.gov.bb/blog/kick-em-jenny-no-direct-threat-to-barbados">https://gisbarbados.gov.bb/blog/kick-em-jenny-no-direct-threat-to-barbados</a></li> <li>• Barbados Government Information Service, 2017. "DEM Monitoring Kick-'em-Jenny". <a href="https://www.nationnews.com/2017/05/01/dem-monitoring-kick-em-jenny-activity/">https://www.nationnews.com/2017/05/01/dem-monitoring-kick-em-jenny-activity/</a></li> <li>• UNESCO Intergovernmental Oceanographic Commission. 2022. <a href="https://www.ctic.ioc-unesco.org/">https://www.ctic.ioc-unesco.org/</a>.</li> <li>• UNESCO Intergovernmental Oceanographic Commission. 2022. "CARIBE WAVE/CARIBE WAVE LANTEX Exercises". <a href="https://www.ctic.ioc-unesco.org/caribe-wave-caribe-wave-lantex-exercises">https://www.ctic.ioc-unesco.org/caribe-wave-caribe-wave-lantex-exercises</a></li> <li>• The Barbados' Second National Communication to the UNFCCC (2018) <a href="https://www4.unfccc.int/sites/SubmissionsStaging/NationalReports/Documents/4693851_Barbados-NC2-1-Barbados%20SNC%20FINAL%20April%202018.pdf">https://www4.unfccc.int/sites/SubmissionsStaging/NationalReports/Documents/4693851_Barbados-NC2-1-Barbados%20SNC%20FINAL%20April%202018.pdf</a></li> <li>• IPCC. 2022. 'IPCC Sixth Assessment Report: Working Group I – The Physical Science Basis: Regional Fact Sheet - Small Islands' <a href="https://www.ipcc.ch/report/ar6/wg1/downloads/factsheets/IPCC_AR6_WGI_Regional_Fact_Sheet_Small_Islands.pdf">https://www.ipcc.ch/report/ar6/wg1/downloads/factsheets/IPCC_AR6_WGI_Regional_Fact_Sheet_Small_Islands.pdf</a></li> <li>• The Coastal Zone Management Unit Website, available at <a href="http://www.coastal.gov.bb">http://www.coastal.gov.bb</a></li> <li>• IPCC. 2022. 'IPCC Sixth Assessment Report: Working Group II – Impacts, Adaptation and Vulnerability. Fact sheet - Small Islands: Climate Change Impacts and Risks', pp. 1-2. Retrieved from <a href="https://www.ipcc.ch/report/ar6/wg2/downloads/outreach/IPCC_AR6_WGII_FactSheet_SmallIslands.pdf">https://www.ipcc.ch/report/ar6/wg2/downloads/outreach/IPCC_AR6_WGII_FactSheet_SmallIslands.pdf</a></li> <li>• IPCC. 2022. "IPCC Sixth Assessment Report: Working Group I – The Physical Science Basis: Regional Fact Sheet - Ocean <a href="https://www.ipcc.ch/report/ar6/wg1/downloads/factsheets/IPCC_AR6_WGI_Regional_Fact_Sheet_Ocean.pdf">https://www.ipcc.ch/report/ar6/wg1/downloads/factsheets/IPCC_AR6_WGI_Regional_Fact_Sheet_Ocean.pdf</a></li> <li>• Country Document for Disaster Risk Reduction: Barbados, 2014 <a href="https://www.preventionweb.net/publication/country-document-disaster-risk-reduction-barbados-2014">https://www.preventionweb.net/publication/country-document-disaster-risk-reduction-barbados-2014</a></li> </ul>

Hazard Category	Hazard Cluster	Hazards identified	Source
Hydro-meteorological	Pressure-related	Depression/ cyclone	<ul style="list-style-type: none"> <li>Country Document for Disaster Risk Reduction: Barbados, 2014 <a href="https://www.preventionweb.net/publication/country-document-disaster-risk-reduction-barbados-2014">https://www.preventionweb.net/publication/country-document-disaster-risk-reduction-barbados-2014</a></li> <li>The Caribbean Catastrophe Risk Insurance Facility. <a href="https://www.ccrif.org/?language_content_entity=en">https://www.ccrif.org/?language_content_entity=en</a></li> <li>The Caribbean Catastrophe Risk Insurance Facility. 2017. "2016-2017 Annual Report". <a href="https://www.ccrif.org/en/publications/annual-report/ccrif-spc-annual-report-2016-2017">https://www.ccrif.org/en/publications/annual-report/ccrif-spc-annual-report-2016-2017</a></li> <li>The Caribbean Catastrophe Risk Insurance Facility. 2017. "2017-2018 Annual Report". <a href="https://www.ccrif.org/en/publications/annual-report/ccrif-spc-annual-report-2017-2018">https://www.ccrif.org/en/publications/annual-report/ccrif-spc-annual-report-2017-2018</a></li> <li>EM-DAT. 2022 "Custom Request for types of hazards affecting Barbados". <a href="https://emdat.be/">https://emdat.be/</a></li> <li>Barbados Government Information Service, 2021. "DEM Reports on Damage from Hurricane Elsa ". <a href="https://gisbarbados.gov.bb/blog/dem-reports-on-damage-from-hurricane-elsa/">https://gisbarbados.gov.bb/blog/dem-reports-on-damage-from-hurricane-elsa/</a></li> <li>United Nations Office for Disaster Risk Reduction (UNISDR). 2011. "Global Assessment Report on Disaster Risk Reduction: Revealing Risk, Redefining Development".</li> </ul>
	Precipitation-related	Drought	<ul style="list-style-type: none"> <li>Country Document for Disaster Risk Reduction: Barbados, 2014 <a href="https://www.preventionweb.net/publication/country-document-disaster-risk-reduction-barbados-2014">https://www.preventionweb.net/publication/country-document-disaster-risk-reduction-barbados-2014</a></li> <li>Chapman, S. C., Chakraborty, S., Dreccer, M. F., &amp; Howden, S. M. (2012). Plant Adaptation to Climate Change: Opportunities and Priorities in breeding. <i>Crop Pastures Science</i>(63), 251-268.</li> <li>FAO. (2016). <i>FAO Water Reports: Drought characteristics and management in the Caribbean</i>. Rome: FAO.</li> <li>Farrell, D., Trotman, A., &amp; Cox, C. (2010). Global Assessment Report on Disaster Risk Reduction. Drought early warning and risk reduction- A case study of the Caribbean Drought of 2009-2010. <i>International Strategy for Drought Reduction (ISDR)</i>.</li> <li>Climate Studies Group Mona. (2020). <i>The State of the Caribbean Climate: Produced for the Caribbean Development Bank</i>.</li> </ul>
	Temperature-related	Heatwave	<ul style="list-style-type: none"> <li>Country Document for Disaster Risk Reduction: Barbados, 2014 <a href="https://www.preventionweb.net/publication/country-document-disaster-risk-reduction-barbados-2014">https://www.preventionweb.net/publication/country-document-disaster-risk-reduction-barbados-2014</a></li> <li>Barbados Government Information Service, 2019. "Health Ministry's Advice to 'Beat the Heat'". <a href="https://gisbarbados.gov.bb/blog/health-ministrys-advice-to-beat-the-heat/">https://gisbarbados.gov.bb/blog/health-ministrys-advice-to-beat-the-heat/</a></li> <li>Barbados Government Information Service, 2019. "Chief Medical Officer's Advice on How to Avoid Heat Stress". <a href="https://gisbarbados.gov.bb/blog/chief-medical-officers-advice-on-how-to-avoid-heat-stress/">https://gisbarbados.gov.bb/blog/chief-medical-officers-advice-on-how-to-avoid-heat-stress/</a></li> <li>Barbados Government Information Service, 2021. "Protect Livestock during Extreme Heat Conditions". <a href="https://gisbarbados.gov.bb/blog/protect-livestock-during-extreme-heat-conditions/">https://gisbarbados.gov.bb/blog/protect-livestock-during-extreme-heat-conditions/</a></li> </ul>

Hazard Category	Hazard Cluster	Hazards identified	Source
Hydro-meteorological	Temperature-related	Heatwave	<ul style="list-style-type: none"> <li>Climate Studies Group Mona. (2020). The State of the Caribbean Climate: Produced for the Caribbean Development Bank. <a href="https://www.caribank.org/sites/default/files/publication-resources/The%20State%20of%20the%20Caribbean%20Climate%20Report.pdf">https://www.caribank.org/sites/default/files/publication-resources/The%20State%20of%20the%20Caribbean%20Climate%20Report.pdf</a></li> </ul>
	Wind-related	Gale (strong gale) Tropical cyclone (cyclonic wind, rain [storm] surge) Tropical Storm Wind	<ul style="list-style-type: none"> <li>Country Document for Disaster Risk Reduction: Barbados, 2014 <a href="https://www.preventionweb.net/publication/country-document-disaster-risk-reduction-barbados-2014">https://www.preventionweb.net/publication/country-document-disaster-risk-reduction-barbados-2014</a></li> <li>Climate Studies Group Mona. (2020). The State of the Caribbean Climate: Produced for the Caribbean Development Bank. The Barbados Meteorological Office, 2022. <a href="https://www.barbadosweather.org/">https://www.barbadosweather.org/</a></li> </ul>
Extra-terrestrial	Extra-terrestrial		Not considered in country documents.
Geohazard	Seismogenic (earthquakes)	Earthquake Tsunami (earthquake trigger)	<ul style="list-style-type: none"> <li>Country Document for Disaster Risk Reduction: Barbados, 2014 <a href="https://www.preventionweb.net/publication/country-document-disaster-risk-reduction-barbados-2014">https://www.preventionweb.net/publication/country-document-disaster-risk-reduction-barbados-2014</a></li> <li>Barbados Government Information Service, 2014 "Earthquakes and Tsunamis No Stranger to Barbados". <a href="https://gisbarbados.gov.bb/blog/earthquakes-and-tsunamis-no-stranger-to-barbados/">https://gisbarbados.gov.bb/blog/earthquakes-and-tsunamis-no-stranger-to-barbados/</a></li> <li>Loop News, 2021. "5.3 Magnitude Earthquake off Barbados felt in parts of Trinidad, Grenada". <a href="https://barbados.loopnews.com/content/53-earthquake-barbados-felt-parts-trinidad-grenada">https://barbados.loopnews.com/content/53-earthquake-barbados-felt-parts-trinidad-grenada</a></li> <li>The University of the West Indies: Seismic Research Centre. 2022. "Earthquake Monitoring". <a href="https://uwiseismic.com/earthquakes/earthquake-monitoring/">https://uwiseismic.com/earthquakes/earthquake-monitoring/</a></li> </ul>
	Volcanogenic (volcanoes and geothermal)	Ash/ Tephra fall (physical and chemical)	<ul style="list-style-type: none"> <li>Country Document for Disaster Risk Reduction: Barbados, 2014 <a href="https://www.preventionweb.net/publication/country-document-disaster-risk-reduction-barbados-2014">https://www.preventionweb.net/publication/country-document-disaster-risk-reduction-barbados-2014</a></li> <li>The University of the West Indies: Seismic Research Centre. 2022. "Volcano Monitoring". <a href="https://uwiseismic.com/volcanoes/volcano-monitoring/">https://uwiseismic.com/volcanoes/volcano-monitoring/</a></li> <li>Barbados Government Information Service, 2021. "Volcanic Ash – Its Effects, Cleaning Methods &amp; More" <a href="https://gisbarbados.gov.bb/blog/volcanic-ash-its-effects-cleaning-methods-more/">https://gisbarbados.gov.bb/blog/volcanic-ash-its-effects-cleaning-methods-more/</a></li> <li>Barbados Today. 2021. "La Soufrière's Good Friday 1979 eruption marked by explosion". <a href="https://barbadostoday.bb/2021/04/14/la-soufrieres-good-friday-1979-eruption-marked-by-explosion/?fbclid=IwAR2jKdEXQwFMF_z29Ue_rGNjcU05b-a9ty1mZnVX6SGY5JQyk7OsHUpat9YBarbados">https://barbadostoday.bb/2021/04/14/la-soufrieres-good-friday-1979-eruption-marked-by-explosion/?fbclid=IwAR2jKdEXQwFMF_z29Ue_rGNjcU05b-a9ty1mZnVX6SGY5JQyk7OsHUpat9YBarbados</a></li> </ul>

Hazard Category	Hazard Cluster	Hazards identified	Source
Geohazard	Volcanogenic (volcanoes and geothermal)	Ash/ Tephra fall (physical and chemical)	<ul style="list-style-type: none"> <li>Government Information Service, 2021. "Minister Caddle: \$87 Million Ashfall Impact". <a href="https://gisbarbados.gov.bb/blog/minister-caddle-87-million-ashfall-impact/Barbados">https://gisbarbados.gov.bb/blog/minister-caddle-87-million-ashfall-impact/Barbados</a> Government Information Service, 2021. "FAQs on the effects of Ash Fall on Crop Production". <a href="https://gisbarbados.gov.bb/blog/faqs-on-effects-of-ash-fall-on-crop-production/">https://gisbarbados.gov.bb/blog/faqs-on-effects-of-ash-fall-on-crop-production/</a></li> <li>Barbados Government Information Service, 2022. "Survey on Impact of Volcanic Ash on Farmers". <a href="https://gisbarbados.gov.bb/blog/survey-on-impact-of-volcanic-ash-on-farmers/">https://gisbarbados.gov.bb/blog/survey-on-impact-of-volcanic-ash-on-farmers/</a></li> <li>Barbados Government Information Service, 2021. "Environment Ministry: No More Ash Collection". <a href="https://gisbarbados.gov.bb/blog/environment-ministry-no-more-ash-collection/">https://gisbarbados.gov.bb/blog/environment-ministry-no-more-ash-collection/</a></li> <li>Hincks et al. 2021. "Volcanic Hazards Atlas of the Lesser Antilles". <a href="https://uwiseismic.com/wp-content/uploads/2021/10/Montserrat.pdf">https://uwiseismic.com/wp-content/uploads/2021/10/Montserrat.pdf</a></li> </ul>
	Volcanogenic (volcanoes and geothermal)	Ground shaking (volcanic earthquake)	<ul style="list-style-type: none"> <li>Country Document for Disaster Risk Reduction: Barbados, 2014 <a href="https://www.preventionweb.net/publication/country-document-disaster-risk-reduction-barbados-2014">https://www.preventionweb.net/publication/country-document-disaster-risk-reduction-barbados-2014</a></li> <li>The University of the West Indies: Seismic Research Centre. 2022. "Volcano Monitoring". <a href="https://uwiseismic.com/volcanoes/volcano-monitoring/">https://uwiseismic.com/volcanoes/volcano-monitoring/</a></li> <li>The University of the West Indies: Seismic Research Centre <a href="https://uwiseismic.com/downloads/seismic-hazard-map/">https://uwiseismic.com/downloads/seismic-hazard-map/</a></li> <li>Climate Studies Group Mona. (2020). The State of the Caribbean Climate: Produced for the Caribbean Development Bank. The University of the West Indies: Seismic Research Centre. 2022. "Earthquake Monitoring". <a href="https://uwiseismic.com/earthquakes/earthquake-monitoring/">https://uwiseismic.com/earthquakes/earthquake-monitoring/</a></li> </ul>
	Volcanogenic (volcanoes and geothermal)	Lightning (volcanic trigger)	<ul style="list-style-type: none"> <li>Country Document for Disaster Risk Reduction: Barbados, 2014 <a href="https://www.preventionweb.net/publication/country-document-disaster-risk-reduction-barbados-2014">https://www.preventionweb.net/publication/country-document-disaster-risk-reduction-barbados-2014</a></li> <li>Loop News. 2021. "Scientists offer look into their lives as La Soufrière volcano erupted". <a href="https://barbados.loopnews.com/content/scientists-offer-look-life-caribbean-volcano-erupted-3">https://barbados.loopnews.com/content/scientists-offer-look-life-caribbean-volcano-erupted-3</a></li> <li>Nation News. 2021. 'Explosion at La Soufrière on Tuesday night'. <a href="https://www.nationnews.com/2021/04/14/explosion-la-soufriere-tuesday-night/">https://www.nationnews.com/2021/04/14/explosion-la-soufriere-tuesday-night/</a></li> <li>Barbados Today. 2021. 'PM promises assistance for those affected by freak storm'. <a href="https://barbadostoday.bb/2021/06/18/pm-promises-assistance-for-those-affected-by-freak-storm/">https://barbadostoday.bb/2021/06/18/pm-promises-assistance-for-those-affected-by-freak-storm/</a></li> </ul>

Hazard Category	Hazard Cluster	Hazards identified	Source
	Volcanogenic (volcanoes and geothermal)	Tsunami (volcanic trigger)	<ul style="list-style-type: none"> <li>Country Document for Disaster Risk Reduction: Barbados, 2014 <a href="https://www.preventionweb.net/publication/country-document-disaster-risk-reduction-barbados-2014">https://www.preventionweb.net/publication/country-document-disaster-risk-reduction-barbados-2014</a></li> <li>The University of the West Indies: Seismic Research Centre. 2022. "Tsunami Monitoring". <a href="https://uwiseismic.com/tsunamis/tsunami-monitoring/">https://uwiseismic.com/tsunamis/tsunami-monitoring/</a></li> <li>Barbados Government Information Service, 2014 "Earthquakes and Tsunamis No Stranger to Barbados". <a href="https://gisbarbados.gov.bb/blog/earthquakes-and-tsunamis-no-stranger-to-barbados/">https://gisbarbados.gov.bb/blog/earthquakes-and-tsunamis-no-stranger-to-barbados/</a></li> <li>The University of the West Indies: Seismic Research Centre. 2022 'Volcanoes – Kick-'em-Jenny'. <a href="https://uwiseismic.com/volcanoes/kick-em-jenny/">https://uwiseismic.com/volcanoes/kick-em-jenny/</a></li> <li>The University of the West Indies: Seismic Research Centre. 2022. "Volcanoes: Kick-'em-Jenny Hazards". <a href="https://uwiseismic.com/volcanoes/kick-em-jenny/kej-hazards/">https://uwiseismic.com/volcanoes/kick-em-jenny/kej-hazards/</a></li> <li>Barbados Government Information Service, 2018. "Kick-'Em-Jenny No Direct Threat to Barbados". <a href="https://gisbarbados.gov.bb/blog/kick-em-jenny-no-direct-threat-to-barbados">https://gisbarbados.gov.bb/blog/kick-em-jenny-no-direct-threat-to-barbados</a></li> <li>Barbados Government Information Service, 2017. "DEM Monitoring Kick-'em-Jenny". <a href="https://www.nationnews.com/2017/05/01/dem-monitoring-kick-em-jenny-activity/">https://www.nationnews.com/2017/05/01/dem-monitoring-kick-em-jenny-activity/</a></li> <li>The University of the West Indies: Seismic Research Centre. 2022. "Volcano Monitoring". <a href="https://uwiseismic.com/volcanoes/volcano-monitoring/">https://uwiseismic.com/volcanoes/volcano-monitoring/</a></li> </ul>
			<ul style="list-style-type: none"> <li>The Barbados' Second National Communication to the UNFCCC (2018) <a href="https://www4.unfccc.int/sites/SubmissionsStaging/NationalReports/Documents/4693851_Barbados-NC2-1-Barbados%20SNC%20FINAL%20April%202018.pdf">https://www4.unfccc.int/sites/SubmissionsStaging/NationalReports/Documents/4693851_Barbados-NC2-1-Barbados%20SNC%20FINAL%20April%202018.pdf</a></li> <li>UNESCO Intergovernmental Oceanographic Commission. 2022. "CARIBE WAVE/CARIBE WAVE LANTEX Exercises". <a href="https://www.ctic.ioc-unesco.org/caribe-wave-caribe-wave-lantex-exercises">https://www.ctic.ioc-unesco.org/caribe-wave-caribe-wave-lantex-exercises</a></li> <li>UNESCO Intergovernmental Oceanographic Commission. 2022. <a href="https://www.ctic.ioc-unesco.org/">https://www.ctic.ioc-unesco.org/</a></li> </ul>
Geohazard	Shallow geohazard	Landslide or Debris flow, including submarine landslides	<ul style="list-style-type: none"> <li>UNESCO. 1993. "The World Heritage Convention: Tentative Lists". <a href="https://whc.unesco.org/en/tentativelists/1993/#:~:text=Coordinates%3A%20Barbados%20is%20located%20at,in%20its%20east%2Dcentral%20part">https://whc.unesco.org/en/tentativelists/1993/#:~:text=Coordinates%3A%20Barbados%20is%20located%20at,in%20its%20east%2Dcentral%20part</a></li> <li>Country Document for Disaster Risk Reduction: Barbados, 2014 <a href="https://www.preventionweb.net/publication/country-document-disaster-risk-reduction-barbados-2014">https://www.preventionweb.net/publication/country-document-disaster-risk-reduction-barbados-2014</a></li> </ul>

Hazard Category	Hazard Cluster	Hazards identified	Source
Geohazard	Shallow geohazard	Landslide or Debris flow, including submarine landslides	<ul style="list-style-type: none"> <li>The Barbados Physical Development Plan. <a href="http://townplanning.gov.bb/physical-development-plan/">http://townplanning.gov.bb/physical-development-plan/</a></li> <li>The University of the West Indies: Seismic Research Centre. 2022. "Tsunami Monitoring". <a href="https://uwiseismic.com/tsunamis/tsunami-monitoring/">https://uwiseismic.com/tsunamis/tsunami-monitoring/</a></li> </ul>
	Shallow geohazard	Ground shaking (induced earthquake, cavity collapse)	<ul style="list-style-type: none"> <li>Country Document for Disaster Risk Reduction: Barbados, 2014 <a href="https://www.preventionweb.net/publication/country-document-disaster-risk-reduction-barbados-2014">https://www.preventionweb.net/publication/country-document-disaster-risk-reduction-barbados-2014</a></li> </ul>
	Shallow geohazard	Aquifer recharge (systems failure/outages)	<ul style="list-style-type: none"> <li>Country Document for Disaster Risk Reduction: Barbados, 2014 <a href="https://www.preventionweb.net/publication/country-document-disaster-risk-reduction-barbados-2014">https://www.preventionweb.net/publication/country-document-disaster-risk-reduction-barbados-2014</a></li> </ul>
	Shallow geohazard	Coastal erosion	<ul style="list-style-type: none"> <li>Country Document for Disaster Risk Reduction: Barbados, 2014 <a href="https://www.preventionweb.net/publication/country-document-disaster-risk-reduction-barbados-2014">https://www.preventionweb.net/publication/country-document-disaster-risk-reduction-barbados-2014</a></li> </ul>
	Shallow geohazard	Rockfall	<ul style="list-style-type: none"> <li>Barbados Government Information Service, 2018. "Guiding Development in Arch Cot, St. Michael". <a href="https://gisbarbados.gov.bb/blog/guiding-development-in-arch-cot-st-michael/">https://gisbarbados.gov.bb/blog/guiding-development-in-arch-cot-st-michael/</a></li> <li>Barbados Government Information Service, 2014. "After Arch Cot". <a href="https://www.nationnews.com/2014/08/31/after-arch-cot/">https://www.nationnews.com/2014/08/31/after-arch-cot/</a></li> <li>Barbados Government Information Service, 2018. "Brittons Hill: 10 Years After the Arch Cot Cave-in". <a href="https://www.youtube.com/watch?v=B6CIEwfaqyM">https://www.youtube.com/watch?v=B6CIEwfaqyM</a></li> </ul>
	Shallow geohazard	Liquefaction (groundwater trigger)	<ul style="list-style-type: none"> <li>Country Document for Disaster Risk Reduction: Barbados, 2014 <a href="https://www.preventionweb.net/publication/country-document-disaster-risk-reduction-barbados-2014">https://www.preventionweb.net/publication/country-document-disaster-risk-reduction-barbados-2014</a></li> </ul>
	Environmental	Environmental degradation	Air pollution (outdoor/chronic) - poor air quality
Environmental degradation		Household air pollution	<ul style="list-style-type: none"> <li>The Barbados' Second National Communication to the UNFCCC (2018) <a href="https://www4.unfccc.int/sites/SubmissionsStaging/NationalReports/Documents/4693851_Barbados-NC2-1-Barbados%20SNC%20FINAL%20April%202018.pdf">https://www4.unfccc.int/sites/SubmissionsStaging/NationalReports/Documents/4693851_Barbados-NC2-1-Barbados%20SNC%20FINAL%20April%202018.pdf</a></li> </ul>

Hazard Category	Hazard Cluster	Hazards identified	Source
Environmental	Environmental degradation	Air pollution (outdoor - result of product combustion and other hazards)	<ul style="list-style-type: none"> <li>Country Document for Disaster Risk Reduction: Barbados, 2014 <a href="https://www.preventionweb.net/publication/country-document-disaster-risk-reduction-barbados-2014">https://www.preventionweb.net/publication/country-document-disaster-risk-reduction-barbados-2014</a></li> <li>The Barbados' Second National Communication to the UNFCCC (2018) <a href="https://www4.unfccc.int/sites/SubmissionsStaging/NationalReports/Documents/4693851_Barbados-NC2-1-Barbados%20SNC%20FINAL%20April%202018.pdf">https://www4.unfccc.int/sites/SubmissionsStaging/NationalReports/Documents/4693851_Barbados-NC2-1-Barbados%20SNC%20FINAL%20April%202018.pdf</a></li> </ul>
	Environmental degradation	Land degradation	<ul style="list-style-type: none"> <li>Country Document for Disaster Risk Reduction: Barbados, 2014 <a href="https://www.preventionweb.net/publication/country-document-disaster-risk-reduction-barbados-2014">https://www.preventionweb.net/publication/country-document-disaster-risk-reduction-barbados-2014</a></li> <li>The Barbados Physical Development Plan. <a href="http://townplanning.gov.bb/physical-development-plan/">http://townplanning.gov.bb/physical-development-plan/</a></li> <li>The Barbados' Second National Communication to the UNFCCC (2018) <a href="https://www4.unfccc.int/sites/SubmissionsStaging/NationalReports/Documents/4693851_Barbados-NC2-1-Barbados%20SNC%20FINAL%20April%202018.pdf">https://www4.unfccc.int/sites/SubmissionsStaging/NationalReports/Documents/4693851_Barbados-NC2-1-Barbados%20SNC%20FINAL%20April%202018.pdf</a></li> <li>UNEP, UWI, Government of Barbados, 2012. The Green Economy Scoping Study – Synthesis Report: Barbados. <a href="https://sdgs.un.org/publications/green-economy-scoping-study-synthesis-report-barbados-17511">https://sdgs.un.org/publications/green-economy-scoping-study-synthesis-report-barbados-17511</a></li> </ul>
	Environmental degradation	Soil degradation	<ul style="list-style-type: none"> <li>The Barbados' Second National Communication to the UNFCCC (2018) <a href="https://www4.unfccc.int/sites/SubmissionsStaging/NationalReports/Documents/4693851_Barbados-NC2-1-Barbados%20SNC%20FINAL%20April%202018.pdf">https://www4.unfccc.int/sites/SubmissionsStaging/NationalReports/Documents/4693851_Barbados-NC2-1-Barbados%20SNC%20FINAL%20April%202018.pdf</a></li> <li>Country Document for Disaster Risk Reduction: Barbados, 2014 <a href="https://www.preventionweb.net/publication/country-document-disaster-risk-reduction-barbados-2014">https://www.preventionweb.net/publication/country-document-disaster-risk-reduction-barbados-2014</a></li> <li>UNEP, UWI, Government of Barbados, 2012. The Green Economy Scoping Study – Synthesis Report: Barbados. <a href="https://sdgs.un.org/publications/green-economy-scoping-study-synthesis-report-barbados-17511">https://sdgs.un.org/publications/green-economy-scoping-study-synthesis-report-barbados-17511</a></li> <li>The Barbados Physical Development Plan. <a href="http://townplanning.gov.bb/physical-development-plan/">http://townplanning.gov.bb/physical-development-plan/</a></li> </ul>
	Environmental degradation	Biodiversity Loss	<ul style="list-style-type: none"> <li>Country Document for Disaster Risk Reduction: Barbados, 2014 <a href="https://www.preventionweb.net/publication/country-document-disaster-risk-reduction-barbados-2014">https://www.preventionweb.net/publication/country-document-disaster-risk-reduction-barbados-2014</a></li> <li>The Barbados' Second National Communication to the UNFCCC (2018) <a href="https://www4.unfccc.int/sites/SubmissionsStaging/NationalReports/Documents/4693851_Barbados-NC2-1-Barbados%20SNC%20FINAL%20April%202018.pdf">https://www4.unfccc.int/sites/SubmissionsStaging/NationalReports/Documents/4693851_Barbados-NC2-1-Barbados%20SNC%20FINAL%20April%202018.pdf</a></li> </ul>

Hazard Category	Hazard Cluster	Hazards identified	Source
Environmental	Environmental degradation	Biodiversity Loss	<ul style="list-style-type: none"> <li>PCC. (2022). IPCC Sixth Assessment Report: Working Group II – Impacts, Adaptation and Vulnerability. Fact sheet-Biodiversity: Climate Change Impacts and Risks, pp. 1-3. <a href="https://www.ipcc.ch/report/ar6/wg2/downloads/outreach/IPCC_AR6_WGII_FactSheet_Biodiversity.pdf">https://www.ipcc.ch/report/ar6/wg2/downloads/outreach/IPCC_AR6_WGII_FactSheet_Biodiversity.pdf</a></li> <li>UNEP, UWI, Government of Barbados, 2012. The Green Economy Scoping Study – Synthesis Report: Barbados. <a href="https://sdgs.un.org/publications/green-economy-scoping-study-synthesis-report-barbados-17511">https://sdgs.un.org/publications/green-economy-scoping-study-synthesis-report-barbados-17511</a></li> </ul>
	Environmental degradation	Deforestation	<ul style="list-style-type: none"> <li>Country Document for Disaster Risk Reduction: Barbados, 2014 <a href="https://www.preventionweb.net/publication/country-document-disaster-risk-reduction-barbados-2014">https://www.preventionweb.net/publication/country-document-disaster-risk-reduction-barbados-2014</a></li> <li>The Barbados' Second National Communication to the UNFCCC (2018) <a href="https://www4.unfccc.int/sites/SubmissionsStaging/NationalReports/Documents/4693851_Barbados-NC2-1-Barbados%20SNC%20FINAL%20April%202018.pdf">https://www4.unfccc.int/sites/SubmissionsStaging/NationalReports/Documents/4693851_Barbados-NC2-1-Barbados%20SNC%20FINAL%20April%202018.pdf</a></li> <li>Intergovernmental Panel on Climate Change. (2022). IPCC Sixth Assessment Report: Working Group II – Impacts, Adaptation and Vulnerability. Fact sheet - Human Settlements: Climate Change Impacts and Risks, pp. 1-3.</li> <li>Intergovernmental Panel on Climate Change. (2022). IPCC Sixth Assessment Report: Working Group II – Impacts, Adaptation and Vulnerability. Fact sheet - Human Settlements: Climate Change Impacts and Risks, pp. 1-3.</li> <li>UNEP, UWI, Government of Barbados, 2012. The Green Economy Scoping Study – Synthesis Report: Barbados. <a href="https://sdgs.un.org/publications/green-economy-scoping-study-synthesis-report-barbados-17511">https://sdgs.un.org/publications/green-economy-scoping-study-synthesis-report-barbados-17511</a></li> <li>The Barbados Physical Development Plan. <a href="http://townplanning.gov.bb/physical-development-plan/">http://townplanning.gov.bb/physical-development-plan/</a></li> </ul>
	Environmental degradation (Forestry)	Wildfires	<ul style="list-style-type: none"> <li>Country Document for Disaster Risk Reduction: Barbados, 2014 <a href="https://www.preventionweb.net/publication/country-document-disaster-risk-reduction-barbados-2014">https://www.preventionweb.net/publication/country-document-disaster-risk-reduction-barbados-2014</a></li> <li>The Barbados National Assessment Report, 2010</li> <li>The Barbados' Second National Communication to the UNFCCC (2018) <a href="https://www4.unfccc.int/sites/SubmissionsStaging/NationalReports/Documents/4693851_Barbados-NC2-1-Barbados%20SNC%20FINAL%20April%202018.pdf">https://www4.unfccc.int/sites/SubmissionsStaging/NationalReports/Documents/4693851_Barbados-NC2-1-Barbados%20SNC%20FINAL%20April%202018.pdf</a></li> <li>Barbados Government Information Service, 2020. "Fighting Fires with Reduced Water Use." <a href="https://gisbarbados.gov.bb/blog/fighting-fires-with-reduced-water-use/">https://gisbarbados.gov.bb/blog/fighting-fires-with-reduced-water-use/</a></li> </ul>

Hazard Category	Hazard Cluster	Hazards identified	Source
Environmental	Environmental degradation (Forestry)	Wildfires	<ul style="list-style-type: none"> <li>IPCC. (2022). IPCC Sixth Assessment Report: Working Group II – Impacts, Adaptation and Vulnerability. Fact sheet-Biodiversity: Climate Change Impacts and Risks, pp. 1-3. <a href="https://www.ipcc.ch/report/ar6/wg2/downloads/outreach/IPCC_AR6_WGII_FactSheet_Biodiversity.pdf">https://www.ipcc.ch/report/ar6/wg2/downloads/outreach/IPCC_AR6_WGII_FactSheet_Biodiversity.pdf</a></li> </ul>
	Environmental degradation	Loss of mangroves	<ul style="list-style-type: none"> <li>The Coastal Zone Management Unit Website, available at <a href="http://www.coastal.gov.bb">http://www.coastal.gov.bb</a></li> <li>The Barbados National Assessment Report, 2010</li> <li>Country Document for Disaster Risk Reduction: Barbados, 2014 <a href="https://www.preventionweb.net/publication/country-document-disaster-risk-reduction-barbados-2014">https://www.preventionweb.net/publication/country-document-disaster-risk-reduction-barbados-2014</a></li> <li>The Barbados' Second National Communication to the UNFCCC (2018) <a href="https://www4.unfccc.int/sites/SubmissionsStaging/NationalReports/Documents/4693851_Barbados-NC2-1-Barbados%20SNC%20FINAL%20April%202018.pdf">https://www4.unfccc.int/sites/SubmissionsStaging/NationalReports/Documents/4693851_Barbados-NC2-1-Barbados%20SNC%20FINAL%20April%202018.pdf</a></li> <li>IPCC. (2022). IPCC Sixth Assessment Report: Working Group II – Impacts, Adaptation and Vulnerability. Fact sheet-Biodiversity: Climate Change Impacts and Risks, pp. 1-3. <a href="https://www.ipcc.ch/report/ar6/wg2/downloads/outreach/IPCC_AR6_WGII_FactSheet_Biodiversity.pdf">https://www.ipcc.ch/report/ar6/wg2/downloads/outreach/IPCC_AR6_WGII_FactSheet_Biodiversity.pdf</a></li> <li>UNEP, UWI, Government of Barbados, 2012. The Green Economy Scoping Study – Synthesis Report: Barbados. <a href="https://sdgs.un.org/publications/green-economy-scoping-study-synthesis-report-barbados-17511">https://sdgs.un.org/publications/green-economy-scoping-study-synthesis-report-barbados-17511</a></li> <li>IPCC. 2022. 'IPCC Sixth Assessment Report: Working Group II – Impacts, Adaptation and Vulnerability. Fact sheet - Small Islands: Climate Change Impacts and Risks', pp. 1-2. Retrieved from <a href="https://www.ipcc.ch/report/ar6/wg2/downloads/outreach/IPCC_AR6_WGII_FactSheet_SmallIslands.pdf">https://www.ipcc.ch/report/ar6/wg2/downloads/outreach/IPCC_AR6_WGII_FactSheet_SmallIslands.pdf</a></li> <li>IPCC. 2022. "IPCC Sixth Assessment Report: Working Group I – The Physical Science Basis: Regional Fact Sheet - Small Islands <a href="https://www.ipcc.ch/report/ar6/wg1/downloads/factsheets/IPCC_AR6_WGI_Regional_Fact_Sheet_Small_Islands.pdf">https://www.ipcc.ch/report/ar6/wg1/downloads/factsheets/IPCC_AR6_WGI_Regional_Fact_Sheet_Small_Islands.pdf</a></li> </ul>
	Environmental degradation	Wetland loss/ degradation	<ul style="list-style-type: none"> <li>The Coastal Zone Management Unit Website, available at <a href="http://www.coastal.gov.bb">http://www.coastal.gov.bb</a></li> <li>Country Document for Disaster Risk Reduction: Barbados, 2014 <a href="https://www.preventionweb.net/publication/country-document-disaster-risk-reduction-barbados-2014">https://www.preventionweb.net/publication/country-document-disaster-risk-reduction-barbados-2014</a></li> <li>The Barbados National Assessment Report, 2010</li> <li>The Barbados' Second National Communication to the UNFCCC (2018)</li> <li>IPCC. (2022). IPCC Sixth Assessment Report: Working Group II – Impacts, Adaptation and Vulnerability. Fact sheet - Human Settlements: Climate Change Impacts and Risks, pp. 1-3.</li> </ul>

Hazard Category	Hazard Cluster	Hazards identified	Source
Environmental	Environmental degradation	Wetland loss/ degradation	<ul style="list-style-type: none"> <li>IPCC. 2022. 'IPCC Sixth Assessment Report: Working Group II – Impacts, Adaptation and Vulnerability. Fact sheet - Small Islands: Climate Change Impacts and Risks', pp. 1-2. Retrieved from <a href="https://www.ipcc.ch/report/ar6/wg2/downloads/outreach/IPCC_AR6_WGII_FactSheet_SmallIslands.pdf">https://www.ipcc.ch/report/ar6/wg2/downloads/outreach/IPCC_AR6_WGII_FactSheet_SmallIslands.pdf</a></li> <li>IPCC. 2022. "IPCC Sixth Assessment Report: Working Group I – The Physical Science Basis: Regional Fact Sheet - Small Islands <a href="https://www.ipcc.ch/report/ar6/wg1/downloads/factsheets/IPCC_AR6_WGI_Regional_Fact_Sheet_Small_Islands.pdf">https://www.ipcc.ch/report/ar6/wg1/downloads/factsheets/IPCC_AR6_WGI_Regional_Fact_Sheet_Small_Islands.pdf</a></li> </ul>
	Environmental degradation	Death of coral reefs (includes bleaching)	<ul style="list-style-type: none"> <li>The Coastal Zone Management Unit Website, available at <a href="http://www.coastal.gov.bb">http://www.coastal.gov.bb</a></li> <li>Country Document for Disaster Risk Reduction: Barbados, 2014 <a href="https://www.preventionweb.net/publication/country-document-disaster-risk-reduction-barbados-2014">https://www.preventionweb.net/publication/country-document-disaster-risk-reduction-barbados-2014</a></li> <li>The Barbados National Assessment Report, 2010</li> <li>The Barbados' Second National Communication to the UNFCCC (2018)</li> <li>IPCC. 2022. 'IPCC Sixth Assessment Report: Working Group II – Impacts, Adaptation and Vulnerability. Fact sheet - Small Islands: Climate Change Impacts and Risks', pp. 1-2. Retrieved from <a href="https://www.ipcc.ch/report/ar6/wg2/downloads/outreach/IPCC_AR6_WGII_FactSheet_SmallIslands.pdf">https://www.ipcc.ch/report/ar6/wg2/downloads/outreach/IPCC_AR6_WGII_FactSheet_SmallIslands.pdf</a></li> <li>IPCC. 2022. "IPCC Sixth Assessment Report: Working Group I – The Physical Science Basis: Regional Fact Sheet - Small Islands <a href="https://www.ipcc.ch/report/ar6/wg1/downloads/factsheets/IPCC_AR6_WGI_Regional_Fact_Sheet_Small_Islands.pdf">https://www.ipcc.ch/report/ar6/wg1/downloads/factsheets/IPCC_AR6_WGI_Regional_Fact_Sheet_Small_Islands.pdf</a></li> </ul>
	Environmental degradation	Soil Erosion	<ul style="list-style-type: none"> <li>Country Document for Disaster Risk Reduction: Barbados, 2014 <a href="https://www.preventionweb.net/publication/country-document-disaster-risk-reduction-barbados-2014">https://www.preventionweb.net/publication/country-document-disaster-risk-reduction-barbados-2014</a></li> </ul>
	Environmental degradation	Coastal erosion and shoreline change	<ul style="list-style-type: none"> <li>The Coastal Zone Management Unit Website, available at <a href="http://www.coastal.gov.bb">http://www.coastal.gov.bb</a></li> <li>Country Document for Disaster Risk Reduction: Barbados, 2014 <a href="https://www.preventionweb.net/publication/country-document-disaster-risk-reduction-barbados-2014">https://www.preventionweb.net/publication/country-document-disaster-risk-reduction-barbados-2014</a></li> <li>The Barbados National Assessment Report, 2010</li> <li>The Barbados' Second National Communication to the UNFCCC (2018)</li> <li>Intergovernmental Panel on Climate Change. (2022). IPCC Sixth Assessment Report: Working Group II – Impacts, Adaptation and Vulnerability. Fact sheet - Responding to Sea Level Rise: Climate Change Impacts and Risks, pp. 1-2.</li> <li>Intergovernmental Panel on Climate Change. (2022). IPCC Sixth Assessment Report: Working Group II – Impacts, Adaptation and Vulnerability. Fact sheet - Human Settlements: Climate Change Impacts and Risks, pp. 1-3.</li> </ul>

Hazard Category	Hazard Cluster	Hazards identified	Source
Environmental	Environmental degradation	Coastal erosion and shoreline change	<ul style="list-style-type: none"> <li>Barbados Government Information Service. (2022, October 1). MP apologises to residents. Retrieved from Barbados Government Information Service Website: <a href="https://www.nationnews.com/2022/10/01/mp-apologises-residents/">https://www.nationnews.com/2022/10/01/mp-apologises-residents/</a></li> </ul>
	Environmental degradation	Sea Level Rise	<ul style="list-style-type: none"> <li>Country Document for Disaster Risk Reduction: Barbados, 2014 <a href="https://www.preventionweb.net/publication/country-document-disaster-risk-reduction-barbados-2014">https://www.preventionweb.net/publication/country-document-disaster-risk-reduction-barbados-2014</a></li> <li>The Coastal Zone Management Unit Website, available at <a href="http://www.coastal.gov.bb">http://www.coastal.gov.bb</a></li> <li>The Barbados' Second National Communication to the UNFCCC (2018) <a href="https://www4.unfccc.int/sites/SubmissionsStaging/NationalReports/Documents/4693851_Barbados-NC2-1-Barbados%20SNC%20FINAL%20April%202018.pdf">https://www4.unfccc.int/sites/SubmissionsStaging/NationalReports/Documents/4693851_Barbados-NC2-1-Barbados%20SNC%20FINAL%20April%202018.pdf</a></li> <li>IPCC. 2022. "IPCC Sixth Assessment Report: Working Group I – The Physical Science Basis: Regional Fact Sheet - Small Islands <a href="https://www.ipcc.ch/report/ar6/wg1/downloads/factsheets/IPCC_AR6_WGI_Regional_Fact_Sheet_Small_Islands.pdf">https://www.ipcc.ch/report/ar6/wg1/downloads/factsheets/IPCC_AR6_WGI_Regional_Fact_Sheet_Small_Islands.pdf</a></li> <li>IPCC Sixth Assessment Report: Working Group II – Impacts, Adaptation and Vulnerability. Fact sheet - Small Islands: Climate Change Impacts and Risks, pp. 1-2. Retrieved from <a href="https://www.ipcc.ch/report/ar6/wg2/downloads/outreach/IPCC_AR6_WGII_FactSheet_SmallIslands.pdf">https://www.ipcc.ch/report/ar6/wg2/downloads/outreach/IPCC_AR6_WGII_FactSheet_SmallIslands.pdf</a></li> </ul>
	Environmental degradation	Eutrophication	<ul style="list-style-type: none"> <li>Country Document for Disaster Risk Reduction: Barbados, 2014 <a href="https://www.preventionweb.net/publication/country-document-disaster-risk-reduction-barbados-2014">https://www.preventionweb.net/publication/country-document-disaster-risk-reduction-barbados-2014</a></li> <li>The Barbados National Assessment Report, 2010</li> <li>IPCC. 2022. "IPCC Sixth Assessment Report: Working Group I – The Physical Science Basis: Regional Fact Sheet - Small Islands <a href="https://www.ipcc.ch/report/ar6/wg2/downloads/outreach/IPCC_AR6_WGII_FactSheet_SmallIslands.pdf">https://www.ipcc.ch/report/ar6/wg2/downloads/outreach/IPCC_AR6_WGII_FactSheet_SmallIslands.pdf</a></li> </ul>
Biological	Aquaculture	Algal bloom	<ul style="list-style-type: none"> <li>The Barbados' Second National Communication to the UNFCCC (2018) <a href="https://www4.unfccc.int/sites/SubmissionsStaging/NationalReports/Documents/4693851_Barbados-NC2-1-Barbados%20SNC%20FINAL%20April%202018.pdf">https://www4.unfccc.int/sites/SubmissionsStaging/NationalReports/Documents/4693851_Barbados-NC2-1-Barbados%20SNC%20FINAL%20April%202018.pdf</a></li> <li>Barbados Government Information Service. 2019. "Sargassum Seaweed A Threat to Caribbean Economies" <a href="https://gisbarbados.gov.bb/blog/sargassum-seaweed-a-threat-to-caribbean-economies/">https://gisbarbados.gov.bb/blog/sargassum-seaweed-a-threat-to-caribbean-economies/</a></li> <li>Country Document for Disaster Risk Reduction: Barbados, 2014 <a href="https://www.preventionweb.net/publication/country-document-disaster-risk-reduction-barbados-2014">https://www.preventionweb.net/publication/country-document-disaster-risk-reduction-barbados-2014</a></li> <li>IPCC. 2022. "IPCC Sixth Assessment Report: Working Group I – The Physical Science Basis: Regional Fact Sheet - Small Islands</li> </ul>

Hazard Category	Hazard Cluster	Hazards identified	Source
Biological	Insect infestation	Insect pest infestation	<ul style="list-style-type: none"> <li>The Barbados' Second National Communication to the UNFCCC (2018) <a href="https://www4.unfccc.int/sites/SubmissionsStaging/NationalReports/Documents/4693851_Barbados-NC2-1-Barbados%20SNC%20FINAL%20April%202018.pdf">https://www4.unfccc.int/sites/SubmissionsStaging/NationalReports/Documents/4693851_Barbados-NC2-1-Barbados%20SNC%20FINAL%20April%202018.pdf</a></li> <li>The Barbados National Assessment Report, 2010</li> <li>Country Document for Disaster Risk Reduction: Barbados, 2014 <a href="https://www.preventionweb.net/publication/country-document-disaster-risk-reduction-barbados-2014">https://www.preventionweb.net/publication/country-document-disaster-risk-reduction-barbados-2014</a></li> </ul>
	Invasive species	Invasive species	<ul style="list-style-type: none"> <li>Government of Barbados. 2015. "Barbados National Report for the Third United Nations Conference on Housing and Sustainable Urban Development: HABITAT III". <a href="https://habitat3.org/wp-content/uploads/Habitat-III-Report-Barbados-final.pdf">https://habitat3.org/wp-content/uploads/Habitat-III-Report-Barbados-final.pdf</a></li> <li>The Barbados' Second National Communication to the UNFCCC (2018) <a href="https://www4.unfccc.int/sites/SubmissionsStaging/NationalReports/Documents/4693851_Barbados-NC2-1-Barbados%20SNC%20FINAL%20April%202018.pdf">https://www4.unfccc.int/sites/SubmissionsStaging/NationalReports/Documents/4693851_Barbados-NC2-1-Barbados%20SNC%20FINAL%20April%202018.pdf</a></li> <li>Barbados Government Information Service. 2019. "Sargassum Seaweed A Threat to Caribbean Economies" <a href="https://gisbarbados.gov.bb/blog/sargassum-seaweed-a-threat-to-caribbean-economies/">https://gisbarbados.gov.bb/blog/sargassum-seaweed-a-threat-to-caribbean-economies/</a></li> <li>Country Document for Disaster Risk Reduction: Barbados, 2014 <a href="https://www.preventionweb.net/publication/country-document-disaster-risk-reduction-barbados-2014">https://www.preventionweb.net/publication/country-document-disaster-risk-reduction-barbados-2014</a></li> </ul>
	Food safety	Antimicrobial resistance	<ul style="list-style-type: none"> <li>Country Document for Disaster Risk Reduction: Barbados, 2014 <a href="https://www.preventionweb.net/publication/country-document-disaster-risk-reduction-barbados-2014">https://www.preventionweb.net/publication/country-document-disaster-risk-reduction-barbados-2014</a></li> <li>Caribbean Community, Caribbean Disaster Emergency Management Agency, World Food Programme, &amp; Food and Drug Administration. (2022). Caribbean Food Security &amp; Livelihoods Survey: Impacts of COVID-19 and the Cost of Living Crisis - Regional Summary Report. World Food Programme. <a href="https://docs.wfp.org/api/documents/WFP-0000142384/download/">https://docs.wfp.org/api/documents/WFP-0000142384/download/</a></li> <li>The Barbados National Assessment Report, 2010</li> <li>Barbados Government Information Service, 2022. "Barbados &amp; Guyana Working to Improve Food Security". <a href="https://gisbarbados.gov.bb/blog/barbados-guyana-working-to-improve-food-security/">https://gisbarbados.gov.bb/blog/barbados-guyana-working-to-improve-food-security/</a></li> <li>Department of Public Information, Guyana. 2022. "Guyana/Barbados food terminal critical to reducing region's food import bill – PM Mottley". <a href="https://dpi.gov.gy/guyana-barbados-food-terminal-critical-to-reducing-regions-food-import-bill-pm-mottley/">https://dpi.gov.gy/guyana-barbados-food-terminal-critical-to-reducing-regions-food-import-bill-pm-mottley/</a></li> <li>Government of Barbados. 2021. "Govt on a 'borrowing binge'". <a href="https://barbadostoday.bb/2021/08/26/govt-on-a-borrowing-binge/">https://barbadostoday.bb/2021/08/26/govt-on-a-borrowing-binge/</a></li> </ul>

Hazard Category	Hazard Cluster	Hazards identified	Source
Biological	Food safety	Antimicrobial resistance	<ul style="list-style-type: none"> <li>The Barbados' Second National Communication to the UNFCCC (2018) <a href="https://www4.unfccc.int/sites/SubmissionsStaging/NationalReports/Documents/4693851_Barbados-NC2-1-Barbados%20SNC%20FINAL%20April%202018.pdf">https://www4.unfccc.int/sites/SubmissionsStaging/NationalReports/Documents/4693851_Barbados-NC2-1-Barbados%20SNC%20FINAL%20April%202018.pdf</a></li> <li>The World Bank. 2021 "Health, Nutrition and Population Statistics". Datasets ranged from 1997-2021.</li> </ul>
	Food Safety	Foodborne microbial hazards (including human enteric virus and foodborne parasite)	<ul style="list-style-type: none"> <li>The Barbados National Assessment Report, 2010</li> <li>The Barbados' Second National Communication to the UNFCCC (2018) <a href="https://www4.unfccc.int/sites/SubmissionsStaging/NationalReports/Documents/4693851_Barbados-NC2-1-Barbados%20SNC%20FINAL%20April%202018.pdf">https://www4.unfccc.int/sites/SubmissionsStaging/NationalReports/Documents/4693851_Barbados-NC2-1-Barbados%20SNC%20FINAL%20April%202018.pdf</a></li> <li>Akpinar-elci, M., &amp; Sealy, H. (2014). Climate Change and Public Health in Small Island States and Caribbean Countries. <i>Global Climate Change and Public Health</i>, 279-292. doi:10.1007/978-1-4614-8417-2_16</li> <li>Pan American Health Organization. (2018). <i>Climate Change and Health in Small Island Developing States: A WHO Special Initiative in collaboration with UNFCCC and the Fijian Presidency of COP-23 - SIDS in the Caribbean Region</i>. Washington, D.C: PAHO.</li> </ul>
	Infectious diseases (plant)	Bacterial plant disease Fungal plant disease Mycoplasma, viral and viroid plant disease	<ul style="list-style-type: none"> <li>The Barbados National Assessment Report, 2010</li> <li>Country Document for Disaster Risk Reduction: Barbados, 2014 <a href="https://www.preventionweb.net/publication/country-document-disaster-risk-reduction-barbados-2014">https://www.preventionweb.net/publication/country-document-disaster-risk-reduction-barbados-2014</a></li> <li>The Barbados' Second National Communication to the UNFCCC (2018) <a href="https://www4.unfccc.int/sites/SubmissionsStaging/NationalReports/Documents/4693851_Barbados-NC2-1-Barbados%20SNC%20FINAL%20April%202018.pdf">https://www4.unfccc.int/sites/SubmissionsStaging/NationalReports/Documents/4693851_Barbados-NC2-1-Barbados%20SNC%20FINAL%20April%202018.pdf</a></li> <li>WFP Caribbean Food Security &amp; Livelihoods Survey – August 2022 <a href="https://docs.wfp.org/api/documents/WFP-0000142384/download/">https://docs.wfp.org/api/documents/WFP-0000142384/download/</a></li> </ul>
	Infectious diseases (human and animal)	Airborne diseases Waterborne diseases Foodborne diseases Vector borne diseases (human)	<ul style="list-style-type: none"> <li>Government of Barbados. 2015. "Barbados National Report for the Third United Nations Conference on Housing and Sustainable Urban Development: HABITAT III". <a href="https://habitat3.org/wp-content/uploads/Habitat-III-Report-Barbados-final.pdf">https://habitat3.org/wp-content/uploads/Habitat-III-Report-Barbados-final.pdf</a></li> <li>Country Document for Disaster Risk Reduction: Barbados, 2014. <a href="https://www.preventionweb.net/publication/country-document-disaster-risk-reduction-barbados-2014">https://www.preventionweb.net/publication/country-document-disaster-risk-reduction-barbados-2014</a></li> <li>Government of Barbados. 2015. "Barbados National Report for the Third United Nations Conference on Housing and Sustainable Urban Development: HABITAT III". <a href="https://habitat3.org/wp-content/uploads/Habitat-III-Report-Barbados-final.pdf">https://habitat3.org/wp-content/uploads/Habitat-III-Report-Barbados-final.pdf</a></li> <li>2012 Annual Report of the Ministry of Health – now known as the Ministry of Health and Wellness, Government of Barbados.</li> </ul>

Hazard Category	Hazard Cluster	Hazards identified	Source
Biological	Infectious diseases (human and animal)	Airborne diseases Waterborne diseases Foodborne diseases Vector borne diseases (human)	<ul style="list-style-type: none"> <li>Akpinar-elci, M., &amp; Sealy, H. (2014). Climate Change and Public Health in Small Island States and Caribbean Countries. <i>Global Climate Change and Public Health</i>, 279-292. doi:10.1007/978-1-4614-8417-2_16</li> <li>Pan American Health Organization. (2018). <i>Climate Change and Health in Small Island Developing States: A WHO Special Initiative in collaboration with UNFCCC and the Fijian Presidency of COP-23 - SIDS in the Caribbean Region</i>. Washington, D.C: PAHO.</li> <li>The Barbados National Assessment Report, 2010</li> <li>Sakhamuri, S., &amp; Cummings, S. (2019). Increasing trans-Atlantic intrusion of Sahara dust: a cause of concern? <i>Elsevier</i>, 1-2.</li> <li>Silva, H. (2015). <i>Climate Change and Public Health</i>. Presentation at the University of Technology, Kingston, Jamaica.</li> <li>World Health Organization. (2009). <i>Country profile of Environmental Burden of Disease: Barbados</i>. Geneva: Public Health and the Environment.</li> <li>World Health Organization. (2014). <i>Quantitative risk assessment of the effects of climate change on selected causes of death, 2030s and 2050s</i>. Geneva: WHO.</li> <li>Griffin, G. (2007). Atmospheric Movement of Microorganisms in Clouds of Desert Dust and Implications for Human Health. <i>Clinical Microbiology Reviews</i>, 20(3), 459–477. doi:10.1128/CMR.00039-06</li> </ul>
	Infectious diseases (human and animal)	Viral haemorrhagic fevers (human)	<ul style="list-style-type: none"> <li>World Health Organization. (2014). <i>Quantitative risk assessment of the effects of climate change on selected causes of death, 2030s and 2050s</i>. Geneva: WHO.</li> <li>World Health Organization. (2009). <i>Country profile of Environmental Burden of Disease: Barbados</i>. Geneva: Public Health and the Environment.</li> <li>Akpinar-elci, M., &amp; Sealy, H. (2014). <i>Climate Change and Public Health in Small Island States and Caribbean Countries</i>. <i>Global Climate Change and Public Health</i>, 279-292. doi:10.1007/978-1-4614-8417-2_16</li> <li>Pan American Health Organization. (2018). <i>Climate Change and Health in Small Island Developing States: A WHO Special Initiative in collaboration with UNFCCC and the Fijian Presidency of COP-23 - SIDS in the Caribbean Region</i>. Washington, D.C: PAHO</li> </ul>
	Infectious diseases (human and animal)	Antimicrobial resistant microorganisms (human)	<ul style="list-style-type: none"> <li>Akpinar-elci, M., &amp; Sealy, H. (2014). <i>Climate Change and Public Health in Small Island States and Caribbean Countries</i>. <i>Global Climate Change and Public Health</i>, 279-292. doi:10.1007/978-1-4614-8417-2_16</li> <li>World Health Organization. (2009). <i>Country profile of Environmental Burden of Disease: Barbados</i>. Geneva: Public Health and the Environment.</li> <li>Pan American Health Organization. (2018). <i>Climate Change and Health in Small Island Developing States: A WHO Special Initiative in collaboration with UNFCCC and the Fijian Presidency of COP-23 - SIDS in the Caribbean Region</i>. Washington, D.C: PAHO.</li> </ul>

Hazard Category	Hazard Cluster	Hazards identified	Source
Biological	Infectious diseases (human and animal)	Antimicrobial resistant microorganisms (human)	<ul style="list-style-type: none"> <li>Government of Barbados. 2015. "Barbados National Report for the Third United Nations Conference on Housing and Sustainable Urban Development: HABITAT III". <a href="https://habitat3.org/wp-content/uploads/Habitat-III-Report-Barbados-final.pdf">https://habitat3.org/wp-content/uploads/Habitat-III-Report-Barbados-final.pdf</a></li> <li>The Barbados National Assessment Report, 2010</li> </ul>
	Infectious diseases (human and animal)	Animal diseases (not zoonoses)	<ul style="list-style-type: none"> <li>The Barbados National Assessment Report, 2010</li> <li>Country Document for Disaster Risk Reduction: Barbados, 2014 <a href="https://www.preventionweb.net/publication/country-document-disaster-risk-reduction-barbados-2014">https://www.preventionweb.net/publication/country-document-disaster-risk-reduction-barbados-2014</a></li> </ul>
	Infectious diseases (human and animal)	Zoonotic diseases	<ul style="list-style-type: none"> <li>The Barbados National Assessment Report, 2010</li> <li>Country Document for Disaster Risk Reduction: Barbados, 2014 <a href="https://www.preventionweb.net/publication/country-document-disaster-risk-reduction-barbados-2014">https://www.preventionweb.net/publication/country-document-disaster-risk-reduction-barbados-2014</a></li> </ul>
	Infectious diseases (human and animal)	Diarrhoeal diseases (human) Cholera (human) Cryptosporidium (human) Paratyphoid fever (human) Typhoid fever (human) Escherichia coli (STEC) (human) Leptospirosis (human) Diphtheria (human)	<ul style="list-style-type: none"> <li>Country Document for Disaster Risk Reduction: Barbados, 2014 <a href="https://www.preventionweb.net/publication/country-document-disaster-risk-reduction-barbados-2014">https://www.preventionweb.net/publication/country-document-disaster-risk-reduction-barbados-2014</a></li> <li>Barbados Government Information Service. (2015, October 9). Hurricane Janet: Her Stories 60 Years later - Part 1. Bridgetown.</li> <li>Barbados Government Information Service. (2016, February 8). Hurricane Janet: Her Stories 60 Years later - Part 2. Bridgetown. The Barbados' Second National Communication to the UNFCCC (2018)</li> <li>Government of Barbados. 2015. "Barbados National Report for the Third United Nations Conference on Housing and Sustainable Urban Development: HABITAT III". <a href="https://habitat3.org/wp-content/uploads/Habitat-III-Report-Barbados-final.pdf">https://habitat3.org/wp-content/uploads/Habitat-III-Report-Barbados-final.pdf</a></li> <li>The Barbados National Assessment Report, 2010</li> </ul>
	Infectious diseases (human and animal)	COVID-19 (SARS-CoV-2) (human)	<ul style="list-style-type: none"> <li>Pan American Health Organization. (2020, August 26). Barbados – An example of government leadership and regional cooperation in containing the COVID-19 virus. Retrieved from Pan American Health Organization Website: <a href="https://www.paho.org/en/documents/barbados-example-government-leadership-and-regional-cooperation-containing-covid-19-virus">https://www.paho.org/en/documents/barbados-example-government-leadership-and-regional-cooperation-containing-covid-19-virus</a></li> <li>Pan American Health Organization. (2020, February 4). PWR-ECC Presents Credentials to Minister of Foreign Affairs in Barbados. Retrieved from Pan American Health Organization Website: <a href="https://www3.paho.org/ecc/index.php?option=com_content&amp;view=article&amp;id=716:pwr-ecc-presents-credentials-to-minister-of-foreign-affairs-in-barbados&amp;Itemid=332">https://www3.paho.org/ecc/index.php?option=com_content&amp;view=article&amp;id=716:pwr-ecc-presents-credentials-to-minister-of-foreign-affairs-in-barbados&amp;Itemid=332</a></li> <li>Pan American Health Organization. (2021, August 4). Barbados receives its third batch of COVID-19 vaccines through the COVAX Facility: <a href="https://www.paho.org/en/news/24-8-2021-barbados-receives-its-third-batch-covid-19-vaccines-through-covax-facility">https://www.paho.org/en/news/24-8-2021-barbados-receives-its-third-batch-covid-19-vaccines-through-covax-facility</a></li> </ul>

Hazard Category	Hazard Cluster	Hazards identified	Source
Biological	Infectious diseases (human and animal)	COVID-19 (SARS-CoV-2) (human)	<ul style="list-style-type: none"> <li>• Pan American Health Organization. (2021, September 9). Hospitals and isolation facilities in the Eastern Caribbean Countries are overwhelmed with the increase of Covid-19 cases combined by shortage of health workforce and clinical supplies. <a href="https://www.paho.org/en/news/27-9-2021-hospitals-and-isolation-facilities-eastern-caribbean-countries-are-overwhelmed">https://www.paho.org/en/news/27-9-2021-hospitals-and-isolation-facilities-eastern-caribbean-countries-are-overwhelmed</a></li> <li>• Pan American Health Organization. (2021). PAHO prepares Barbados for COVID-19 testing. <a href="https://www.paho.org/en/stories/paho-prepares-barbados-covid-19-testing">https://www.paho.org/en/stories/paho-prepares-barbados-covid-19-testing</a></li> <li>• Pan American Health Organization. (2022, May 5). PAHO receives Humanitarian Award from Barbados for its support during the COVID-19 pandemic. Retrieved from Pan American Health Organization Website: <a href="https://www.paho.org/en/news/5-5-2022-paho-receives-humanitarian-award-barbados-its-support-during-covid-19-pandemic">https://www.paho.org/en/news/5-5-2022-paho-receives-humanitarian-award-barbados-its-support-during-covid-19-pandemic</a></li> <li>• Pan American Health Organization. (2022). PAHO: Barbados and the Eastern Caribbean Countries. <a href="https://www.paho.org/en/barbados-and-eastern-caribbean-countries">https://www.paho.org/en/barbados-and-eastern-caribbean-countries</a></li> <li>• World Health Organization. (2009). Country profile of Environmental Burden of Disease: Barbados. Geneva: Public Health and the Environment.</li> <li>• World Health Organization. (2014). Quantitative risk assessment of the effects of climate change on selected causes of death, 2030s and 2050s. Geneva: WHO.</li> <li>• World Health Organization. (2022). WHO Coronavirus (COVID-19) Dashboard. Retrieved from World Health Organization.</li> <li>• Barbados Government Information Service. (2019, March 2). Old Naval Base as could be used for COVID-19. <a href="https://gisbarbados.gov.bb/blog/old-naval-base-could-be-used-for-covid-19/">https://gisbarbados.gov.bb/blog/old-naval-base-could-be-used-for-covid-19/</a></li> <li>• Barbados Government Information Service. (2019, February 1). Prime Minister praised for Handling of COVID-19 fight. <a href="https://gisbarbados.gov.bb/blog/prime-minister-praised-for-handling-of-covid-19-fight">https://gisbarbados.gov.bb/blog/prime-minister-praised-for-handling-of-covid-19-fight</a></li> <li>• Caribbean Community, Caribbean Disaster Emergency Management Agency, World Food Programme , &amp; Food and Drug Administration. (2022). Caribbean Food Security &amp; Livelihoods Survey: Impacts of COVID-19 and the Cost of Living Crisis - Regional Summary Report. World Food Programme.</li> <li>• Barbados Government Information Service. (2020). COVID-19 . <a href="https://gisbarbados.gov.bb/covid-19/">https://gisbarbados.gov.bb/covid-19/</a></li> <li>• Barbados Government Information Service. (2020, March 29). Cuban Nurses on the way to help in COVID-19 fight. <a href="https://gisbarbados.gov.bb/blog/cuban-nurses-on-the-way-to-help-in-covid-19-fight/">https://gisbarbados.gov.bb/blog/cuban-nurses-on-the-way-to-help-in-covid-19-fight/</a></li> <li>• Barbados Government Information Service. (2020, April 11). Shopping Schedule during COVID -19 Curfew. <a href="https://gisbarbados.gov.bb/blog/shopping-schedule-during-covid-19-curfew/">https://gisbarbados.gov.bb/blog/shopping-schedule-during-covid-19-curfew/</a></li> <li>• Barbados Government Information Service. (2022, August 27). Barbados receives Pfizer COVID-19 Vaccines for Children. <a href="https://gisbarbados.gov.bb/blog/barbados-receives-pfizer-covid-19-vaccines-for-children">https://gisbarbados.gov.bb/blog/barbados-receives-pfizer-covid-19-vaccines-for-children</a></li> </ul>

Hazard Category	Hazard Cluster	Hazards identified	Source
Biological	Infectious diseases (human and animal)	COVID-19 (SARS-CoV-2) (human)	<ul style="list-style-type: none"> <li>Barbados Government Information Service. (2022, August 26). Barbados receives Pfizer COVID-19 vaccines for children 12 and under. <a href="https://www.youtube.com/watch?v=tzwjvVSgYeY">https://www.youtube.com/watch?v=tzwjvVSgYeY</a></li> <li>Barbados Government Information Service. (2022). National Protocols. <a href="https://gisbarbados.gov.bb/covid-19-protocols/">https://gisbarbados.gov.bb/covid-19-protocols/</a></li> <li>Barbados Government Information Service. (2022, November 21). Prime Minister Mottley: Lessons To Be Learnt From COVID-19 Fight. <a href="https://gisbarbados.gov.bb/blog/prime-minister-mottley-lessons-to-be-learnt-from-covid-19-fight/">https://gisbarbados.gov.bb/blog/prime-minister-mottley-lessons-to-be-learnt-from-covid-19-fight/</a></li> <li>Mulder, N. (2020). The impact of the COVID-19 pandemic on the tourism sector in Latin America and the Caribbean, and options for a sustainable and resilient recovery. United Nations Economic Commission for Latin America and the Caribbean. <a href="http://hdl.handle.net/11362/46502">http://hdl.handle.net/11362/46502</a></li> </ul>
	Infectious diseases (human and animal)	Foot and mouth disease virus (animal)	<ul style="list-style-type: none"> <li>The Barbados National Assessment Report, 2010</li> <li>World Health Organization. (2009). Country profile of Environmental Burden of Disease: Barbados. Geneva: Public Health and the Environment.</li> </ul>
	Infectious diseases (human and animal)	Chikungunya Zika virus (human) Dengue (human)	<ul style="list-style-type: none"> <li>The Barbados National Assessment Report, 2010</li> <li>Country Document for Disaster Risk Reduction: Barbados, 2014 <a href="https://www.preventionweb.net/publication/country-document-disaster-risk-reduction-barbados-2014">https://www.preventionweb.net/publication/country-document-disaster-risk-reduction-barbados-2014</a></li> <li>World Health Organization. (2009). Country profile of Environmental Burden of Disease: Barbados. Geneva: Public Health and the Environment.</li> </ul>
Chemical	Aquaculture	Marine toxins	<ul style="list-style-type: none"> <li>IPCC. 2022. 'IPCC Sixth Assessment Report: Working Group I – The Physical Science Basis: Regional Fact Sheet - Ocean <a href="https://www.ipcc.ch/report/ar6/wg1/downloads/factsheets/IPCC_AR6_WGI_Regional_Fact_Sheet_Ocean.pdf">https://www.ipcc.ch/report/ar6/wg1/downloads/factsheets/IPCC_AR6_WGI_Regional_Fact_Sheet_Ocean.pdf</a></li> <li>The Barbados' Second National Communication to the UNFCCC (2018) <a href="https://www4.unfccc.int/sites/SubmissionsStaging/NationalReports/Documents/4693851_Barbados-NC2-1-Barbados%20SNC%20FINAL%20April%202018.pdf">https://www4.unfccc.int/sites/SubmissionsStaging/NationalReports/Documents/4693851_Barbados-NC2-1-Barbados%20SNC%20FINAL%20April%202018.pdf</a></li> <li>Country Document for Disaster Risk Reduction: Barbados, 2014 <a href="https://www.preventionweb.net/publication/country-document-disaster-risk-reduction-barbados-2014">https://www.preventionweb.net/publication/country-document-disaster-risk-reduction-barbados-2014</a></li> <li>The Barbados National Assessment Report, 2010</li> <li>The Coastal Zone Management Unit Website, available at <a href="http://www.coastal.gov.bb">http://www.coastal.gov.bb</a></li> <li>PCC. 2022. 'IPCC Sixth Assessment Report: Working Group II – Impacts, Adaptation and Vulnerability. Fact sheet - Small Islands: Climate Change Impacts and Risks', pp. 1-2. Retrieved from <a href="https://www.ipcc.ch/report/ar6/wg2/downloads/outreach/IPCC_AR6_WGII_FactSheet_SmallIslands.pdf">https://www.ipcc.ch/report/ar6/wg2/downloads/outreach/IPCC_AR6_WGII_FactSheet_SmallIslands.pdf</a></li> </ul>

Hazard Category	Hazard Cluster	Hazards identified	Source
Chemical	Aquaculture	Marine toxins	<ul style="list-style-type: none"> <li>The University of the West Indies; Government of Barbados; United Nations Development Programme. (2018). The Barbados Blue Economy Scoping Study: Stocktake and Diagnostic Analysis</li> <li>Caribbean Development Bank. (2018). Financing the Blue Economy: A Caribbean Development Opportunity.</li> </ul>
	Hydrocarbons	Oil pollution	<ul style="list-style-type: none"> <li>National Geographic. 2010. "Ten years later, BP oil spill continues to harm wildlife—especially dolphins" <a href="https://www.nationalgeographic.com/animals/article/how-is-wildlife-doing-now--ten-years-after-the-deepwater-horizon">https://www.nationalgeographic.com/animals/article/how-is-wildlife-doing-now--ten-years-after-the-deepwater-horizon</a></li> <li>CARICOM Today. 2020. "Potential Oil Spill Threatens Caribbean Sea". <a href="https://today.caricom.org/2020/10/20/potential-oil-spill-threatens-caribbean-sea/">https://today.caricom.org/2020/10/20/potential-oil-spill-threatens-caribbean-sea/</a></li> <li>The Barbados National Assessment Report, 2010</li> <li>The Barbados' Second National Communication to the UNFCCC (2018) <a href="https://www4.unfccc.int/sites/SubmissionsStaging/NationalReports/Documents/4693851_Barbados-NC2-1-Barbados%20SNC%20FINAL%20April%202018.pdf">https://www4.unfccc.int/sites/SubmissionsStaging/NationalReports/Documents/4693851_Barbados-NC2-1-Barbados%20SNC%20FINAL%20April%202018.pdf</a></li> <li>Country Document for Disaster Risk Reduction: Barbados, 2014 <a href="https://www.preventionweb.net/publication/country-document-disaster-risk-reduction-barbados-2014">https://www.preventionweb.net/publication/country-document-disaster-risk-reduction-barbados-2014</a></li> <li>UNEP, UWI, Government of Barbados, 2012. The Green Economy Scoping Study – Synthesis Report: Barbados. <a href="https://sdgs.un.org/publications/green-economy-scoping-study-synthesis-report-barbados-17511">https://sdgs.un.org/publications/green-economy-scoping-study-synthesis-report-barbados-17511</a></li> </ul>
	Persistent organic pollutants (POPs)	Hazardous pesticide contamination in soils Pesticides - highly hazardous Residue of pesticides including POPs Insecticides Fungicides Phosphides Chlorine	<ul style="list-style-type: none"> <li>The Barbados' Second National Communication to the UNFCCC (2018) <a href="https://www4.unfccc.int/sites/SubmissionsStaging/NationalReports/Documents/4693851_Barbados-NC2-1-Barbados%20SNC%20FINAL%20April%202018.pdf">https://www4.unfccc.int/sites/SubmissionsStaging/NationalReports/Documents/4693851_Barbados-NC2-1-Barbados%20SNC%20FINAL%20April%202018.pdf</a></li> <li>Country Document for Disaster Risk Reduction: Barbados, 2014 <a href="https://www.preventionweb.net/publication/country-document-disaster-risk-reduction-barbados-2014">https://www.preventionweb.net/publication/country-document-disaster-risk-reduction-barbados-2014</a></li> <li>The Barbados National Assessment Report, 2010</li> <li>UNEP, UWI, Government of Barbados, 2012. The Green Economy Scoping Study – Synthesis Report: Barbados. <a href="https://sdgs.un.org/publications/green-economy-scoping-study-synthesis-report-barbados-17511">https://sdgs.un.org/publications/green-economy-scoping-study-synthesis-report-barbados-17511</a></li> </ul>
Persistent organic pollutants (POPs)	Microplastics	<ul style="list-style-type: none"> <li>The Barbados National Assessment Report, 2010</li> <li>The Coastal Zone Management Unit Website, available at <a href="http://www.coastal.gov.bb">http://www.coastal.gov.bb</a></li> <li>IPCC. 2022. 'IPCC Sixth Assessment Report: Working Group II – Impacts, Adaptation and Vulnerability. Fact sheet - Small Islands: Climate Change Impacts and Risks', pp. 1-2. Retrieved from <a href="https://www.ipcc.ch/report/ar6/wg2/downloads/outreach/IPCC_AR6_WGII_FactSheet_SmallIslands.pdf">https://www.ipcc.ch/report/ar6/wg2/downloads/outreach/IPCC_AR6_WGII_FactSheet_SmallIslands.pdf</a></li> <li>IPCC. 2022. "IPCC Sixth Assessment Report: Working Group I – The Physical Science Basis: Regional Fact Sheet - Ocean" <a href="https://www.ipcc.ch/report/ar6/wg1/downloads/factsheets/IPCC_AR6_WGI_Regional_FactSheet_Ocean.pdf">https://www.ipcc.ch/report/ar6/wg1/downloads/factsheets/IPCC_AR6_WGI_Regional_FactSheet_Ocean.pdf</a></li> </ul>	

Hazard Category	Hazard Cluster	Hazards identified	Source
Chemical	Persistent organic pollutants (POPs)	Microplastics	<ul style="list-style-type: none"> <li>The Barbados' Second National Communication to the UNFCCC (2018) <a href="https://www4.unfccc.int/sites/SubmissionsStaging/NationalReports/Documents/4693851_Barbados-NC2-1-Barbados%20SNC%20FINAL%20April%202018.pdf">https://www4.unfccc.int/sites/SubmissionsStaging/NationalReports/Documents/4693851_Barbados-NC2-1-Barbados%20SNC%20FINAL%20April%202018.pdf</a></li> <li>Country Document for Disaster Risk Reduction: Barbados, 2014 <a href="https://www.preventionweb.net/publication/country-document-disaster-risk-reduction-barbados-2014">https://www.preventionweb.net/publication/country-document-disaster-risk-reduction-barbados-2014</a></li> <li>NationNews. 2019. "Update: Fire at Recycling Plant". <a href="https://www.nationnews.com/2019/08/13/update-fire-at-recycling-business/">https://www.nationnews.com/2019/08/13/update-fire-at-recycling-business/</a></li> <li>BGIS, 2021. "Significant Progress Made At B's Recycling Plant". <a href="https://gisbarbados.gov.bb/blog/significant-progress-made-at-bs-recycling-plant">https://gisbarbados.gov.bb/blog/significant-progress-made-at-bs-recycling-plant</a></li> </ul>
Technological	Construction/ Structural failure	Building collapse	<ul style="list-style-type: none"> <li>BGIS. 2021. "DEM Reports On Damage From Hurricane Elsa ". <a href="https://gisbarbados.gov.bb/blog/dem-reports-on-damage-from-hurricane-elsa/">https://gisbarbados.gov.bb/blog/dem-reports-on-damage-from-hurricane-elsa/</a>. Initially, the Department of Emergency Management noted that 2,372 problems reported: (1,333 reports of roof damage; 326 reports of other house damage; 145 reports of total house collapse)</li> <li>Country Document for Disaster Risk Reduction: Barbados, 2014 <a href="https://www.preventionweb.net/publication/country-document-disaster-risk-reduction-barbados-2014">https://www.preventionweb.net/publication/country-document-disaster-risk-reduction-barbados-2014</a></li> <li>EM-DAT   The international disasters database. 2022 "Custom Request for types of hazards affecting Barbados".</li> <li>Barbados Advocate. 2021. "Maintenance key to prevent sick buildings". <a href="https://www.barbadosadvocate.com/news/maintenance-key-prevent-sick-buildings">https://www.barbadosadvocate.com/news/maintenance-key-prevent-sick-buildings</a></li> <li>The 2014 Barbados HABITAT III Report</li> <li>NationNews. 2021. 'Duguid: Hurricane StrapIt to save roofs'. <a href="https://www.nationnews.com/2021/07/06/duguid-hurricane-strapit-save-roofs/">https://www.nationnews.com/2021/07/06/duguid-hurricane-strapit-save-roofs/</a></li> <li>LoopNews. 2021. "Improving Barbados' housing infrastructure a priority". <a href="https://barbados.loopnews.com/content/improving-barbados-housing-infrastructure-priority">https://barbados.loopnews.com/content/improving-barbados-housing-infrastructure-priority</a></li> <li>Barbados Fire Service. (2016). Annual Report . Bridgetown: Barbados Fire Service.</li> </ul>
	Construction/ Structural failure	Structural collapse (standing structure)	<ul style="list-style-type: none"> <li>Country Document for Disaster Risk Reduction: Barbados, 2014 <a href="https://www.preventionweb.net/publication/country-document-disaster-risk-reduction-barbados-2014">https://www.preventionweb.net/publication/country-document-disaster-risk-reduction-barbados-2014</a></li> <li>BGIS. 2021. "DEM Reports On Damage From Hurricane Elsa ". <a href="https://gisbarbados.gov.bb/blog/dem-reports-on-damage-from-hurricane-elsa/">https://gisbarbados.gov.bb/blog/dem-reports-on-damage-from-hurricane-elsa/</a>.</li> <li>EM-DAT   The international disasters database. 2022 "Custom Request for types of hazards affecting Barbados".</li> <li>The 2014 Barbados HABITAT III Report</li> <li>NationNews. 2021. 'Duguid: Hurricane StrapIt to save roofs'. <a href="https://www.nationnews.com/2021/07/06/duguid-hurricane-strapit-save-roofs/">https://www.nationnews.com/2021/07/06/duguid-hurricane-strapit-save-roofs/</a></li> </ul>

Hazard Category	Hazard Cluster	Hazards identified	Source
Technological	Construction/ Structural failure	Structural collapse (standing structure)	<ul style="list-style-type: none"> <li>• LoopNews. 2021. "Improving Barbados' housing infrastructure a priority". <a href="https://barbados.loopnews.com/content/improving-barbados-housing-infrastructure-priority">https://barbados.loopnews.com/content/improving-barbados-housing-infrastructure-priority</a></li> <li>• Barbados Advocate. 2021. "Maintenance key to prevent sick buildings". <a href="https://www.barbadosadvocate.com/news/maintenance-key-prevent-sick-buildings">https://www.barbadosadvocate.com/news/maintenance-key-prevent-sick-buildings</a></li> <li>• Barbados Advocate. 2020. Editorial: Fire Safety Still A Priority. <a href="https://www.barbadosadvocate.com/columns/editorial-fire-safety-still-priority">https://www.barbadosadvocate.com/columns/editorial-fire-safety-still-priority</a></li> <li>• Barbados Government Information Service. 2019. Significant Increase In Fires For 2019. <a href="https://gisbarbados.gov.bb/blog/significant-increase-in-fires-for-2019/">https://gisbarbados.gov.bb/blog/significant-increase-in-fires-for-2019/</a></li> <li>• Barbados Fire Service. (2016). Annual Report . Bridgetown: Barbados Fire Service.</li> </ul>
	Infrastructure failure	Supply systems failure	<ul style="list-style-type: none"> <li>• BGIS. 2018. "South Coast Sewage Issue Deemed A National Crisis". <a href="https://gisbarbados.gov.bb/blog/south-coast-sewage-issue-deemed-a-national-crisis/">https://gisbarbados.gov.bb/blog/south-coast-sewage-issue-deemed-a-national-crisis/</a></li> <li>• Barbados Today. (2022, May 15). BWA addressing burst water mains across the island. Retrieved from Barbados Today Website: <a href="https://barbadostoday.bb/2022/05/15/bwa-addressing-bursts-across-the-island/">https://barbadostoday.bb/2022/05/15/bwa-addressing-bursts-across-the-island/</a></li> <li>• UNEP, UWI, Government of Barbados, 2012. The Green Economy Scoping Study – Synthesis Report: Barbados. <a href="https://sdgs.un.org/publications/green-economy-scoping-study-synthesis-report-barbados-17511">https://sdgs.un.org/publications/green-economy-scoping-study-synthesis-report-barbados-17511</a></li> <li>• Country Document for Disaster Risk Reduction: Barbados, 2014 <a href="https://www.preventionweb.net/publication/country-document-disaster-risk-reduction-barbados-2014">https://www.preventionweb.net/publication/country-document-disaster-risk-reduction-barbados-2014</a></li> <li>• Water Security Risk Index, 2010. <a href="https://www.industryweek.com/finance/article/22010379/maplecrofts-2010-water-security-risk-index-identifies-ten-countries-at-extreme-risk">https://www.industryweek.com/finance/article/22010379/maplecrofts-2010-water-security-risk-index-identifies-ten-countries-at-extreme-risk</a></li> <li>• 2020 Water Protection and Land Use Zoning Policy <a href="https://energy.gov.bb/our-projects/2020-water-protection-and-land-use-zoning-policy/">https://energy.gov.bb/our-projects/2020-water-protection-and-land-use-zoning-policy/</a></li> </ul>
	Infrastructure failure	Infrastructure failure	<ul style="list-style-type: none"> <li>• The 2014 Barbados HABITAT III Report</li> <li>• Country Document for Disaster Risk Reduction: Barbados, 2014 <a href="https://www.preventionweb.net/publication/country-document-disaster-risk-reduction-barbados-2014">https://www.preventionweb.net/publication/country-document-disaster-risk-reduction-barbados-2014</a></li> <li>• MOVE - Movilidad Eléctrica en Latinoamérica. 2021. "Electric buses implementation in Barbados". <a href="https://www.youtube.com/watch?v=VFXG80dfq-Y">https://www.youtube.com/watch?v=VFXG80dfq-Y</a></li> <li>• Barbados Today. 2021. "Transport Board says electric buses worth it". <a href="https://barbadostoday.bb/2021/12/30/transport-board-says-electric-buses-worth-it/">https://barbadostoday.bb/2021/12/30/transport-board-says-electric-buses-worth-it/</a></li> <li>• Barbados Today. 2021. "New garbage collection, recycling system rolls out". <a href="https://barbadostoday.bb/2021/09/30/new-garbage-collection-recycling-system-rolls-out/">https://barbadostoday.bb/2021/09/30/new-garbage-collection-recycling-system-rolls-out/</a></li> <li>• BGIS. 2019. "10 New Garbage Trucks As Promised". <a href="https://gisbarbados.gov.bb/blog/10-new-garbage-trucks-as-promised/">https://gisbarbados.gov.bb/blog/10-new-garbage-trucks-as-promised/</a></li> </ul>

Hazard Category	Hazard Cluster	Hazards identified	Source
Technological	Infrastructure failure	Infrastructure failure	<ul style="list-style-type: none"> <li>UNEP, UWI, Government of Barbados, 2012. The Green Economy Scoping Study – Synthesis Report: Barbados. <a href="https://sdgs.un.org/publications/green-economy-scoping-study-synthesis-report-barbados-17511">https://sdgs.un.org/publications/green-economy-scoping-study-synthesis-report-barbados-17511</a></li> </ul>
	Infrastructure failure	Power outage/or blackout	<ul style="list-style-type: none"> <li>Barbados Government Information Service, 2021. 'Barbados Light &amp; Power's Restoration Efforts Continue'. <a href="https://gisbarbados.gov.bb/blog/barbados-light-powers-restoration-efforts-continue/">https://gisbarbados.gov.bb/blog/barbados-light-powers-restoration-efforts-continue/</a></li> </ul>
	Infrastructure failure	Emergency telecommunications failure	<ul style="list-style-type: none"> <li>Barbados Government Information Service, 2021. 'Barbados Light &amp; Power's Restoration Efforts Continue'. <a href="https://gisbarbados.gov.bb/blog/barbados-light-powers-restoration-efforts-continue/">https://gisbarbados.gov.bb/blog/barbados-light-powers-restoration-efforts-continue/</a></li> <li>Barbados Today. 2020. "Rare internet outage strikes Barbados, Eastern Caribbean". <a href="https://barbadostoday.bb/2020/12/08/rare-internet-outage-strikes-barbados-eastern-caribbean/">https://barbadostoday.bb/2020/12/08/rare-internet-outage-strikes-barbados-eastern-caribbean/</a></li> <li>Barbados Advocate. 2020. Editorial: Fire Safety Still A Priority. <a href="https://www.barbadosadvocate.com/columns/editorial-fire-safety-still-priority">https://www.barbadosadvocate.com/columns/editorial-fire-safety-still-priority</a></li> <li>Barbados Government Information Service. 2019. Significant Increase In Fires For 2019. <a href="https://gisbarbados.gov.bb/blog/significant-increase-in-fires-for-2019/">https://gisbarbados.gov.bb/blog/significant-increase-in-fires-for-2019/</a></li> <li>NationNews. 2022. 'Disruption of services continue at QEH'. <a href="https://www.nationnews.com/2022/12/15/disruption-services-continue-qeh/">https://www.nationnews.com/2022/12/15/disruption-services-continue-qeh/</a></li> <li>NationNews. 2022. 'Possible delays at QEH due to internet issues'. <a href="https://www.nationnews.com/2022/12/14/qeh-changes-due-internet-issues/?fbclid=IwAR0-RoQNYLny_DG2CSQKe9PwgeN0P0-bclSFHUQpR62KZU_6V8Vvs_qOxEE">https://www.nationnews.com/2022/12/14/qeh-changes-due-internet-issues/?fbclid=IwAR0-RoQNYLny_DG2CSQKe9PwgeN0P0-bclSFHUQpR62KZU_6V8Vvs_qOxEE</a></li> </ul>
	Infrastructure failure	Radio and other telecommunication failures	<ul style="list-style-type: none"> <li>Barbados Today. 2020. "Rare internet outage strikes Barbados, Eastern Caribbean". <a href="https://barbadostoday.bb/2020/12/08/rare-internet-outage-strikes-barbados-eastern-caribbean/">https://barbadostoday.bb/2020/12/08/rare-internet-outage-strikes-barbados-eastern-caribbean/</a></li> </ul>
	Cyber hazard	Malware Data breach Data security-related hazards Disrupt Outage	<ul style="list-style-type: none"> <li>NationNews. 2022. 'Disruption of services continue at QEH'. <a href="https://www.nationnews.com/2022/12/15/disruption-services-continue-qeh/">https://www.nationnews.com/2022/12/15/disruption-services-continue-qeh/</a></li> <li>NationNews. 2022. 'Government boosting IT system after breach'. <a href="https://www.nationnews.com/2022/03/11/government-boosting-system-breach/">https://www.nationnews.com/2022/03/11/government-boosting-system-breach/</a></li> <li>NationNews. 2022. 'Possible delays at QEH due to internet issues'. <a href="https://www.nationnews.com/2022/12/14/qeh-changes-due-internet-issues/?fbclid=IwAR0-RoQNYLny_DG2CSQKe9PwgeN0P0-bclSFHUQpR62KZU_6V8Vvs_qOxEE">https://www.nationnews.com/2022/12/14/qeh-changes-due-internet-issues/?fbclid=IwAR0-RoQNYLny_DG2CSQKe9PwgeN0P0-bclSFHUQpR62KZU_6V8Vvs_qOxEE</a></li> </ul>

Hazard Category	Hazard Cluster	Hazards identified	Source
Technological	Industrial failure / Non-compliance	Contamination	<ul style="list-style-type: none"> <li>The Barbados' Second National Communication to the UNFCCC (2018) <a href="https://www4.unfccc.int/sites/SubmissionsStaging/NationalReports/Documents/4693851_Barbados-NC2-1-Barbados%20SNC%20FINAL%20April%202018.pdf">https://www4.unfccc.int/sites/SubmissionsStaging/NationalReports/Documents/4693851_Barbados-NC2-1-Barbados%20SNC%20FINAL%20April%202018.pdf</a></li> <li>Country Document for Disaster Risk Reduction: Barbados, 2014 <a href="https://www.preventionweb.net/publication/country-document-disaster-risk-reduction-barbados-2014">https://www.preventionweb.net/publication/country-document-disaster-risk-reduction-barbados-2014</a></li> <li>The Barbados National Assessment Report, 2010</li> <li>National Geographic. 2010. "Ten years later, BP oil spill continues to harm wildlife—especially dolphins" <a href="https://www.nationalgeographic.com/animals/article/how-is-wildlife-doing-now--ten-years-after-the-deepwater-horizon">https://www.nationalgeographic.com/animals/article/how-is-wildlife-doing-now--ten-years-after-the-deepwater-horizon</a></li> </ul>
	Industrial failure / Non-compliance	Spills Explosions Leaks	<ul style="list-style-type: none"> <li>The Barbados National Assessment Report, 2010</li> <li>Country Document for Disaster Risk Reduction: Barbados, 2014 <a href="https://www.preventionweb.net/publication/country-document-disaster-risk-reduction-barbados-2014">https://www.preventionweb.net/publication/country-document-disaster-risk-reduction-barbados-2014</a></li> <li>CARICOM Today. 2020. "Potential Oil Spill Threatens Caribbean Sea". <a href="https://today.caricom.org/2020/10/20/potential-oil-spill-threatens-caribbean-sea/">https://today.caricom.org/2020/10/20/potential-oil-spill-threatens-caribbean-sea/</a></li> <li>National Geographic. 2010. "Ten years later, BP oil spill continues to harm wildlife—especially dolphins" <a href="https://www.nationalgeographic.com/animals/article/how-is-wildlife-doing-now--ten-years-after-the-deepwater-horizon">https://www.nationalgeographic.com/animals/article/how-is-wildlife-doing-now--ten-years-after-the-deepwater-horizon</a></li> <li>The Barbados' Second National Communication to the UNFCCC (2018) <a href="https://www4.unfccc.int/sites/SubmissionsStaging/NationalReports/Documents/4693851_Barbados-NC2-1-Barbados%20SNC%20FINAL%20April%202018.pdf">https://www4.unfccc.int/sites/SubmissionsStaging/NationalReports/Documents/4693851_Barbados-NC2-1-Barbados%20SNC%20FINAL%20April%202018.pdf</a></li> </ul>
	Industrial failure / Non-compliance	Fire	<ul style="list-style-type: none"> <li>Country Document for Disaster Risk Reduction: Barbados, 2014 <a href="https://www.preventionweb.net/publication/country-document-disaster-risk-reduction-barbados-2014">https://www.preventionweb.net/publication/country-document-disaster-risk-reduction-barbados-2014</a></li> <li>Barbados Fire Service. (2016). Annual Report . Bridgetown: Barbados Fire Service.</li> </ul>
	Waste	Hazardous waste Disaster waste	<ul style="list-style-type: none"> <li>The Barbados' Second National Communication to the UNFCCC (2018) <a href="https://www4.unfccc.int/sites/SubmissionsStaging/NationalReports/Documents/4693851_Barbados-NC2-1-Barbados%20SNC%20FINAL%20April%202018.pdf">https://www4.unfccc.int/sites/SubmissionsStaging/NationalReports/Documents/4693851_Barbados-NC2-1-Barbados%20SNC%20FINAL%20April%202018.pdf</a></li> <li>The Barbados National Assessment Report, 2010</li> </ul>
	Waste	Plastic waste	<ul style="list-style-type: none"> <li>Country Document for Disaster Risk Reduction: Barbados, 2014 <a href="https://www.preventionweb.net/publication/country-document-disaster-risk-reduction-barbados-2014">https://www.preventionweb.net/publication/country-document-disaster-risk-reduction-barbados-2014</a></li> <li>The Barbados National Assessment Report, 2010</li> </ul>

Hazard Category	Hazard Cluster	Hazards identified	Source
Technological	Waste	Plastic waste	<ul style="list-style-type: none"> <li>NationNews. 2019. "Update: Fire at Recycling Plant". <a href="https://www.nationnews.com/2019/08/13/update-fire-at-recycling-business/">https://www.nationnews.com/2019/08/13/update-fire-at-recycling-business/</a></li> <li>BGIS, 2021. "Significant Progress Made At B's Recycling Plant". <a href="https://gisbarbados.gov.bb/blog/significant-progress-made-at-bs-recycling-plant/">https://gisbarbados.gov.bb/blog/significant-progress-made-at-bs-recycling-plant/</a></li> <li>The Barbados' Second National Communication to the UNFCCC (2018) <a href="https://www4.unfccc.int/sites/SubmissionsStaging/NationalReports/Documents/4693851_Barbados-NC2-1-Barbados%20SNC%20FINAL%20April%202018.pdf">https://www4.unfccc.int/sites/SubmissionsStaging/NationalReports/Documents/4693851_Barbados-NC2-1-Barbados%20SNC%20FINAL%20April%202018.pdf</a></li> <li>UNEP, UWI, Government of Barbados, 2012. The Green Economy Scoping Study – Synthesis Report: Barbados. <a href="https://sdgs.un.org/publications/green-economy-scoping-study-synthesis-report-barbados-17511">https://sdgs.un.org/publications/green-economy-scoping-study-synthesis-report-barbados-17511</a></li> </ul>
	Waste	Marine debris	<ul style="list-style-type: none"> <li>The Coastal Zone Management Unit Website, available at <a href="http://www.coastal.gov.bb">http://www.coastal.gov.bb</a></li> <li>Country Document for Disaster Risk Reduction: Barbados, 2014 <a href="https://www.preventionweb.net/publication/country-document-disaster-risk-reduction-barbados-2014">https://www.preventionweb.net/publication/country-document-disaster-risk-reduction-barbados-2014</a></li> <li>The Barbados' Second National Communication to the UNFCCC (2018) <a href="https://www4.unfccc.int/sites/SubmissionsStaging/NationalReports/Documents/4693851_Barbados-NC2-1-Barbados%20SNC%20FINAL%20April%202018.pdf">https://www4.unfccc.int/sites/SubmissionsStaging/NationalReports/Documents/4693851_Barbados-NC2-1-Barbados%20SNC%20FINAL%20April%202018.pdf</a></li> <li>The Barbados National Assessment Report, 2010</li> <li>UNEP, UWI, Government of Barbados, 2012. The Green Economy Scoping Study – Synthesis Report: Barbados. <a href="https://sdgs.un.org/publications/green-economy-scoping-study-synthesis-report-barbados-17511">https://sdgs.un.org/publications/green-economy-scoping-study-synthesis-report-barbados-17511</a></li> </ul>
	Waste	Drain and sewer flooding Wastewater Healthcare risk waste	<ul style="list-style-type: none"> <li>BGIS. 2018. "South Coast Sewage Issue Deemed A National Crisis". <a href="https://gisbarbados.gov.bb/blog/south-coast-sewage-issue-deemed-a-national-crisis/">https://gisbarbados.gov.bb/blog/south-coast-sewage-issue-deemed-a-national-crisis/</a></li> </ul>
	Waste	Solid waste E-waste Landfilling	<ul style="list-style-type: none"> <li>The -Country Document for Disaster Risk Reduction: Barbados, 2014 <a href="https://www.preventionweb.net/publication/country-document-disaster-risk-reduction-barbados-2014">https://www.preventionweb.net/publication/country-document-disaster-risk-reduction-barbados-2014</a></li> <li>The Barbados' Second National Communication to the UNFCCC (2018) <a href="https://www4.unfccc.int/sites/SubmissionsStaging/NationalReports/Documents/4693851_Barbados-NC2-1-Barbados%20SNC%20FINAL%20April%202018.pdf">https://www4.unfccc.int/sites/SubmissionsStaging/NationalReports/Documents/4693851_Barbados-NC2-1-Barbados%20SNC%20FINAL%20April%202018.pdf</a></li> <li>UNEP, UWI, Government of Barbados, 2012. The Green Economy Scoping Study – Synthesis Report: Barbados. <a href="https://sdgs.un.org/publications/green-economy-scoping-study-synthesis-report-barbados-17511">https://sdgs.un.org/publications/green-economy-scoping-study-synthesis-report-barbados-17511</a> The Barbados National Assessment Report, 2010</li> </ul>

Hazard Category	Hazard Cluster	Hazards identified	Source
Technological	Waste	Solid waste E-waste Landfilling	<ul style="list-style-type: none"> <li>Barbados Today. 2021. "New garbage collection, recycling system rolls out". <a href="https://barbadostoday.bb/2021/09/30/new-garbage-collection-recycling-system-rolls-out/">https://barbadostoday.bb/2021/09/30/new-garbage-collection-recycling-system-rolls-out/</a></li> <li>BGIS. 2019. "10 New Garbage Trucks As Promised". <a href="https://gisbarbados.gov.bb/blog/10-new-garbage-trucks-as-promised/">https://gisbarbados.gov.bb/blog/10-new-garbage-trucks-as-promised/</a></li> </ul>
	Transportation	Road traffic accident	<ul style="list-style-type: none"> <li>Country Document for Disaster Risk Reduction: Barbados, 2014 <a href="https://www.preventionweb.net/publication/country-document-disaster-risk-reduction-barbados-2014">https://www.preventionweb.net/publication/country-document-disaster-risk-reduction-barbados-2014</a></li> <li>The World Bank. 2022. "The World Development Indicators".</li> <li>The Barbados National Assessment Report, 2010</li> <li>UNEP, UWI, Government of Barbados, 2012. The Green Economy Scoping Study – Synthesis Report: Barbados. <a href="https://sdgs.un.org/publications/green-economy-scoping-study-synthesis-report-barbados-17511">https://sdgs.un.org/publications/green-economy-scoping-study-synthesis-report-barbados-17511</a></li> </ul>
Societal	Conflict	Civil Unrest	<ul style="list-style-type: none"> <li>Barbados Government Information Service, 2022. "Attorney General Addresses Recent Increase in Gun Crimes". <a href="https://gisbarbados.gov.bb/blog/attorney-general-addresses-recent-increase-in-gun-crimes/">https://gisbarbados.gov.bb/blog/attorney-general-addresses-recent-increase-in-gun-crimes/</a></li> <li>UNODC 2022. United Nations Office on Drugs and Crime. "Country Profile: Barbados". <a href="https://dataunodc.un.org/content/country-list">https://dataunodc.un.org/content/country-list</a></li> </ul>
	Behavioural	Violence	<ul style="list-style-type: none"> <li>Barbados Today. 2022. "CCB concerned Bajans not speaking up about child abuse" <a href="https://barbadostoday.bb/2022/04/02/ccb-concerned-bajans-not-speaking-up-about-child-abuse/">https://barbadostoday.bb/2022/04/02/ccb-concerned-bajans-not-speaking-up-about-child-abuse/</a></li> <li>Barbados Today. 2021. "Griffith: Elder abuse a big problem in Barbados". <a href="https://barbadostoday.bb/2021/06/15/griffith-elder-abuse-a-big-problem-in-barbados/">https://barbadostoday.bb/2021/06/15/griffith-elder-abuse-a-big-problem-in-barbados/</a></li> <li>NationNews. 2022. "Call for tougher laws to fight elder abuse". <a href="https://www.nationnews.com/2022/06/13/call-tougher-laws-fight-elder-abuse/">https://www.nationnews.com/2022/06/13/call-tougher-laws-fight-elder-abuse/</a></li> </ul>
	Economic	Financial Shock	<ul style="list-style-type: none"> <li>The Barbados Statistical Service. 2022. "Unemployment rate". <a href="https://stats.gov.bb/?s=unemployment+rate">https://stats.gov.bb/?s=unemployment+rate</a>.</li> <li>The World Bank. 2022. "The World Development Indicators".</li> <li>Government of Barbados. 2021. "Govt on a 'borrowing binge'". <a href="https://barbadostoday.bb/2021/08/26/govt-on-a-borrowing-binge/">https://barbadostoday.bb/2021/08/26/govt-on-a-borrowing-binge/</a></li> </ul>

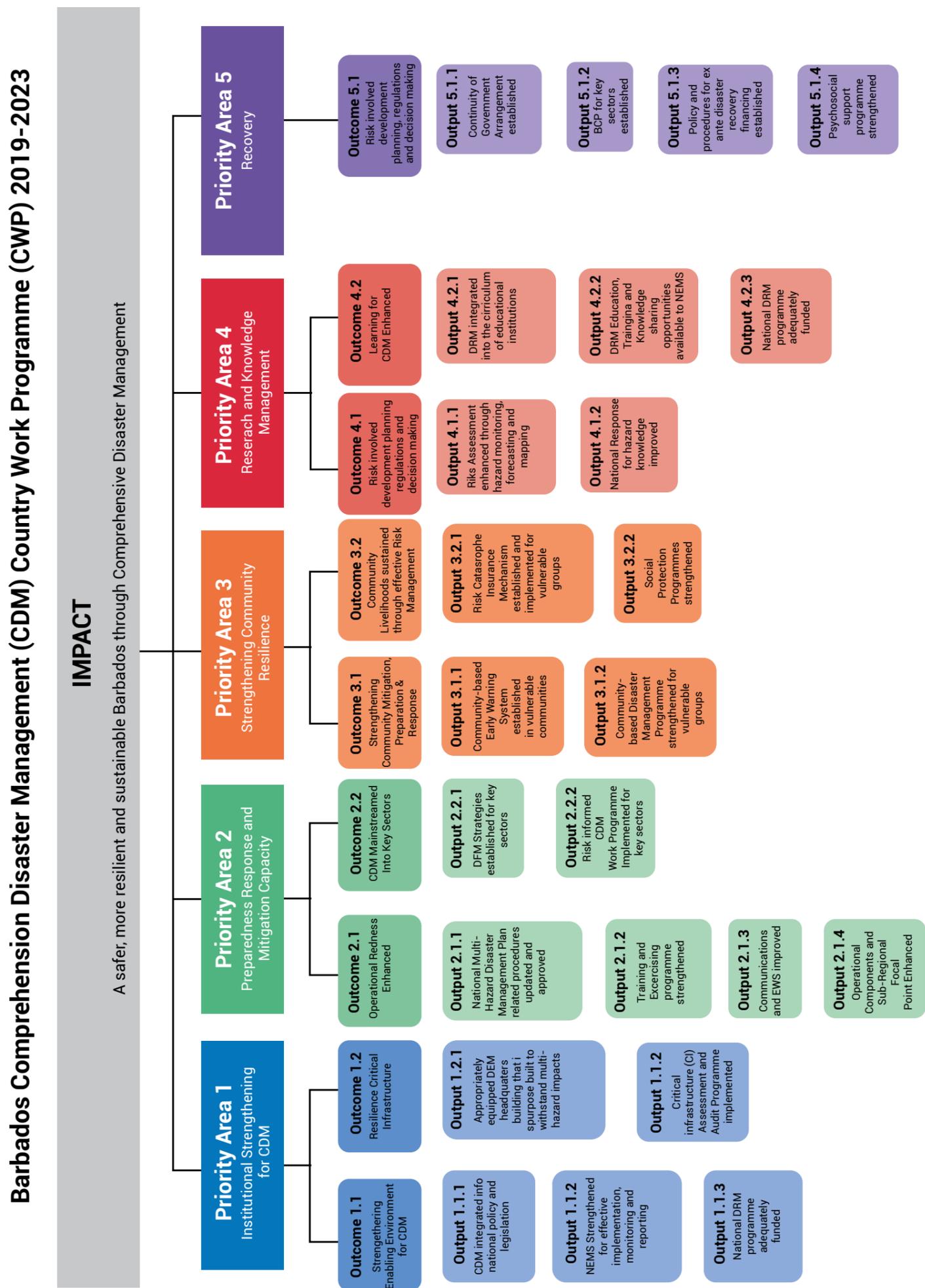
**Table 25: Risk Components - Vulnerability and Exposure**

Risk Component	Source
Social Vulnerability	United Nations Children's Fund. (2019). A Situational Analysis of Children in the Eastern Caribbean. Bridgetown : UNICEF Eastern Caribbean . Retrieved from <a href="https://www.unicef.org/easterncaribbean/reports/situation-analysis-children-eastern-caribbean-area">https://www.unicef.org/easterncaribbean/reports/situation-analysis-children-eastern-caribbean-area</a>
	Country Document for Disaster Risk Reduction: Barbados, 2014 <a href="https://www.preventionweb.net/publication/country-document-disaster-risk-reduction-barbados-2018">https://www.preventionweb.net/publication/country-document-disaster-risk-reduction-barbados-2018</a>
	BGIS 2019. "Shopping Schedule during COVID -19 Curfew". <a href="https://gisbarbados.gov.bb/blog/shopping-schedule-during-covid-19-curfew/">https://gisbarbados.gov.bb/blog/shopping-schedule-during-covid-19-curfew/</a>
	BGIS. 2021 'Attorney General Explains State of Emergency Extension' <a href="https://gisbarbados.gov.bb/blog/attorney-general-explains-state-of-emergency-extension/">https://gisbarbados.gov.bb/blog/attorney-general-explains-state-of-emergency-extension/</a> .
	BGIS. 2019. " National Protocols". <a href="https://gisbarbados.gov.bb/covid-19-protocols/">https://gisbarbados.gov.bb/covid-19-protocols/</a>
	BGIS. 2019. "Old Naval Base as could be used for COVID-19". <a href="https://gisbarbados.gov.bb/blog/old-naval-base-could-be-used-for-covid-19/">https://gisbarbados.gov.bb/blog/old-naval-base-could-be-used-for-covid-19/</a>
	BGIS. 2019. "Harrison Point receives first patients". <a href="https://gisbarbados.gov.bb/blog/harrison-point-receives-first-patients/">https://gisbarbados.gov.bb/blog/harrison-point-receives-first-patients/</a>
	BGIS. 2019. "Deeper Health Cooperation with Cuba". <a href="https://gisbarbados.gov.bb/blog/deeper-health-cooperation-with-cuba/">https://gisbarbados.gov.bb/blog/deeper-health-cooperation-with-cuba/</a> ; <a href="https://gisbarbados.gov.bb/blog/six-more-months-for-cuban-nurses-in-barbados/">https://gisbarbados.gov.bb/blog/six-more-months-for-cuban-nurses-in-barbados/</a> .
	BGIS. 2019. "Cuban Nurses on the way to help in COVID-19 fight". <a href="https://gisbarbados.gov.bb/blog/cuban-nurses-on-the-way-to-help-in-covid-19-fight/">https://gisbarbados.gov.bb/blog/cuban-nurses-on-the-way-to-help-in-covid-19-fight/</a> ; <a href="https://gisbarbados.gov.bb/blog/barbados-cuba-sign-a-health-cooperation-agreement/">https://gisbarbados.gov.bb/blog/barbados-cuba-sign-a-health-cooperation-agreement/</a> .
	Pan-American Health Organization. 2021. "PAHO prepares Barbados for COVID-19 testing". <a href="https://www.paho.org/en/stories/paho-prepares-barbados-covid-19-testing">https://www.paho.org/en/stories/paho-prepares-barbados-covid-19-testing</a>
	BGIS. 2021. "Employees must have a pass not letter from employer". <a href="https://gisbarbados.gov.bb/blog/employees-must-have-a-pass-not-letter-from-employer/">https://gisbarbados.gov.bb/blog/employees-must-have-a-pass-not-letter-from-employer/</a>
	BGIS. 2021. "Home Quarantine & Isolation to ease Facilities. <a href="https://gisbarbados.gov.bb/blog/home-quarantine-isolation-to-ease-facilities/">https://gisbarbados.gov.bb/blog/home-quarantine-isolation-to-ease-facilities/</a>
	The Barbados COVID_19 Tracker. Available at: <a href="https://covid19.trackvaccines.org/country/barbados/">https://covid19.trackvaccines.org/country/barbados/</a>
	UNDP, UNICEF, UN Women. 2020. "Barbados COVID-19 HEAT Report, Human and Economic Assessment of Impact".
	BGIS. 2022. "Barbados receives Pfizer COVID-19 vaccines for children 12 and under". <a href="https://www.youtube.com/watch?v=tzwjvVSgYeY">https://www.youtube.com/watch?v=tzwjvVSgYeY</a> .
	BGIS. 2022. "USA Donates Pfizer to Barbados. Available at: <a href="https://gisbarbados.gov.bb/blog/barbados-receives-129600-vaccines-from-us/">https://gisbarbados.gov.bb/blog/barbados-receives-129600-vaccines-from-us/</a> and <a href="https://gisbarbados.gov.bb/blog/70200-pfizer-vaccines-arrive-in-barbados/">https://gisbarbados.gov.bb/blog/70200-pfizer-vaccines-arrive-in-barbados/</a> .
	Government of Barbados. 2015. "Barbados National Report for the Third United Nations Conference on Housing and Sustainable Urban Development: HABITAT III". <a href="https://habitat3.org/wp-content/uploads/Habitat-III-Report-Barbados-final.pdf">https://habitat3.org/wp-content/uploads/Habitat-III-Report-Barbados-final.pdf</a>
BGIS, 2022. "Statement on Construction of Steel-Framed Houses from China". <a href="https://gisbarbados.gov.bb/blog/statement-by-housing-minister-on-the-construction-of-steel-framed-houses-from-china/">https://gisbarbados.gov.bb/blog/statement-by-housing-minister-on-the-construction-of-steel-framed-houses-from-china/</a>	
BGIS. 2022. "Barbados receives Pfizer COVID-19 Vaccines for Children". <a href="https://gisbarbados.gov.bb/blog/barbados-receives-pfizer-covid-19-vaccines-for-children">https://gisbarbados.gov.bb/blog/barbados-receives-pfizer-covid-19-vaccines-for-children</a>	

Risk Component	Source
Social Vulnerability	The Barbados Survey of Living Conditions 2016-2017
	BGIS. 2022. "Barbados Reaches Deal On New Extended Fund Facility". <a href="https://gisbarbados.gov.bb/blog/barbados-reaches-deal-on-new-extended-fund-facility/">https://gisbarbados.gov.bb/blog/barbados-reaches-deal-on-new-extended-fund-facility/</a>
Economic Vulnerability	Barbados Government Information Service, 2021. 'Barbados Light & Power's Restoration Efforts Continue'. <a href="https://gisbarbados.gov.bb/blog/barbados-light-powers-restoration-efforts-continue/">https://gisbarbados.gov.bb/blog/barbados-light-powers-restoration-efforts-continue/</a>
	The Government of Barbados. 2013 "The Barbados Medium Term Growth and Development Strategy (2013 – 2020): Recovery, Adjustment and Sustainable Development." <a href="https://caribbean.eclac.org/publications/barbados-growth-and-development-strategy-2013-2020">https://caribbean.eclac.org/publications/barbados-growth-and-development-strategy-2013-2020</a>
	Government of Barbados. 2021. "Govt on a 'borrowing binge'". <a href="https://barbadostoday.bb/2021/08/26/govt-on-a-borrowing-binge/">https://barbadostoday.bb/2021/08/26/govt-on-a-borrowing-binge/</a>
	Country Document for Disaster Risk Reduction: Barbados, 2014 <a href="https://www.preventionweb.net/publication/country-document-disaster-risk-reduction-barbados-2018">https://www.preventionweb.net/publication/country-document-disaster-risk-reduction-barbados-2018</a>
	BGIS. 2022. "Barbados Reaches Deal On New Extended Fund Facility". <a href="https://gisbarbados.gov.bb/blog/barbados-reaches-deal-on-new-extended-fund-facility/">https://gisbarbados.gov.bb/blog/barbados-reaches-deal-on-new-extended-fund-facility/</a>
Physical Vulnerability	Country Document for Disaster Risk Reduction: Barbados, 2014 <a href="https://www.preventionweb.net/publication/country-document-disaster-risk-reduction-barbados-2018">https://www.preventionweb.net/publication/country-document-disaster-risk-reduction-barbados-2018</a>
	Barbados Today. 2019. "Bad roads across Barbados". <a href="https://barbadostoday.bb/2019/02/20/bad-roads-across-barbados/">https://barbadostoday.bb/2019/02/20/bad-roads-across-barbados/</a>
	Barbados was ranked 108th attaining a score of 3.2 over the period 2006-2019. <a href="https://www.theglobaleconomy.com/rankings/roads_quality/">https://www.theglobaleconomy.com/rankings/roads_quality/</a>
	The 2014 Barbados HABITAT III Report
	BGIS. 2022. "Statement on Construction of Steel-Framed Houses From China". <a href="https://gisbarbados.gov.bb/blog/statement-by-housing-minister-on-the-construction-of-steel-framed-houses-from-china/">https://gisbarbados.gov.bb/blog/statement-by-housing-minister-on-the-construction-of-steel-framed-houses-from-china/</a>
	BGIS. 2021. "DEM Reports On Damage From Hurricane Elsa ". <a href="https://gisbarbados.gov.bb/blog/dem-reports-on-damage-from-hurricane-elsa/">https://gisbarbados.gov.bb/blog/dem-reports-on-damage-from-hurricane-elsa/</a> .
	EM-DAT   The international disasters database. 2022 "Custom Request for types of hazards affecting Barbados".
	Barbados Government Information Service, 2018. 'Guiding Development in Arch Cot, St. Michael' . <a href="https://gisbarbados.gov.bb/blog/guiding-development-in-arch-cot-st-michael/">https://gisbarbados.gov.bb/blog/guiding-development-in-arch-cot-st-michael/</a>
	Barbados Government Information Service, 2018. 'Guiding Development in Arch Cot, St. Michael' . <a href="https://gisbarbados.gov.bb/blog/guiding-development-in-arch-cot-st-michael/">https://gisbarbados.gov.bb/blog/guiding-development-in-arch-cot-st-michael/</a>
Barbados Government Information Service, 2018. 'Guiding Development in Arch Cot, St. Michael' . <a href="https://gisbarbados.gov.bb/blog/guiding-development-in-arch-cot-st-michael/">https://gisbarbados.gov.bb/blog/guiding-development-in-arch-cot-st-michael/</a>	
Environmental Vulnerability	UNDRR. 2022. 'The Caribbean is at the forefront of Early Warning Systems'. <a href="https://www.undrr.org/news/caribbean-forefront-early-warning-systems">https://www.undrr.org/news/caribbean-forefront-early-warning-systems</a>
	Barbados Today. 2022. 'Region to get funding for resilience efforts'. <a href="https://barbadostoday.bb/2022/10/13/region-to-get-funding-for-resilience-efforts/">https://barbadostoday.bb/2022/10/13/region-to-get-funding-for-resilience-efforts/</a>

# APPENDIX II: The Barbados CDM Country Work Programme (CWP) 2019-2023

Figure 84: The Barbados CDM Country Work Programme (CWP) 2019-2023



Source: The Department of Emergency Management

Cross-cutting considerations: Gender and Vulnerable Groups; Climate Change; Information and Communication Technologies; and Environmental sustainability

# APPENDIX III: EMAC Membership

Figure 85: Representative organizations of the Emergency Management Advisory Council

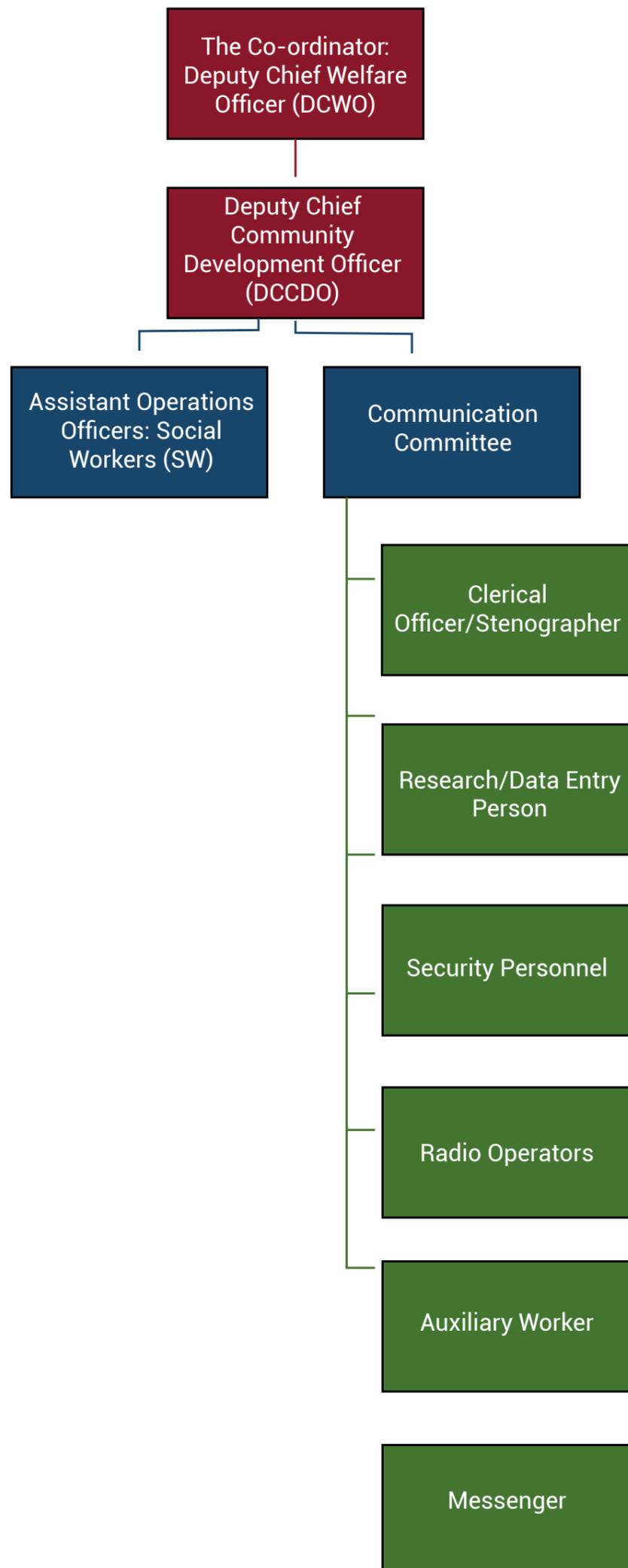


Source: The Department of Emergency Management

N.B Other stakeholders including private sector, civil society organisations, media and academia can be co-opted as required.

# APPENDIX IV: NEOC Membership

Figure 86: The Management Structure of the NEOC



Source: Ministry of People Empowerment and Elder Affairs, 2022

Figure 87: Disaster Social Relief Committee Organizational Chart



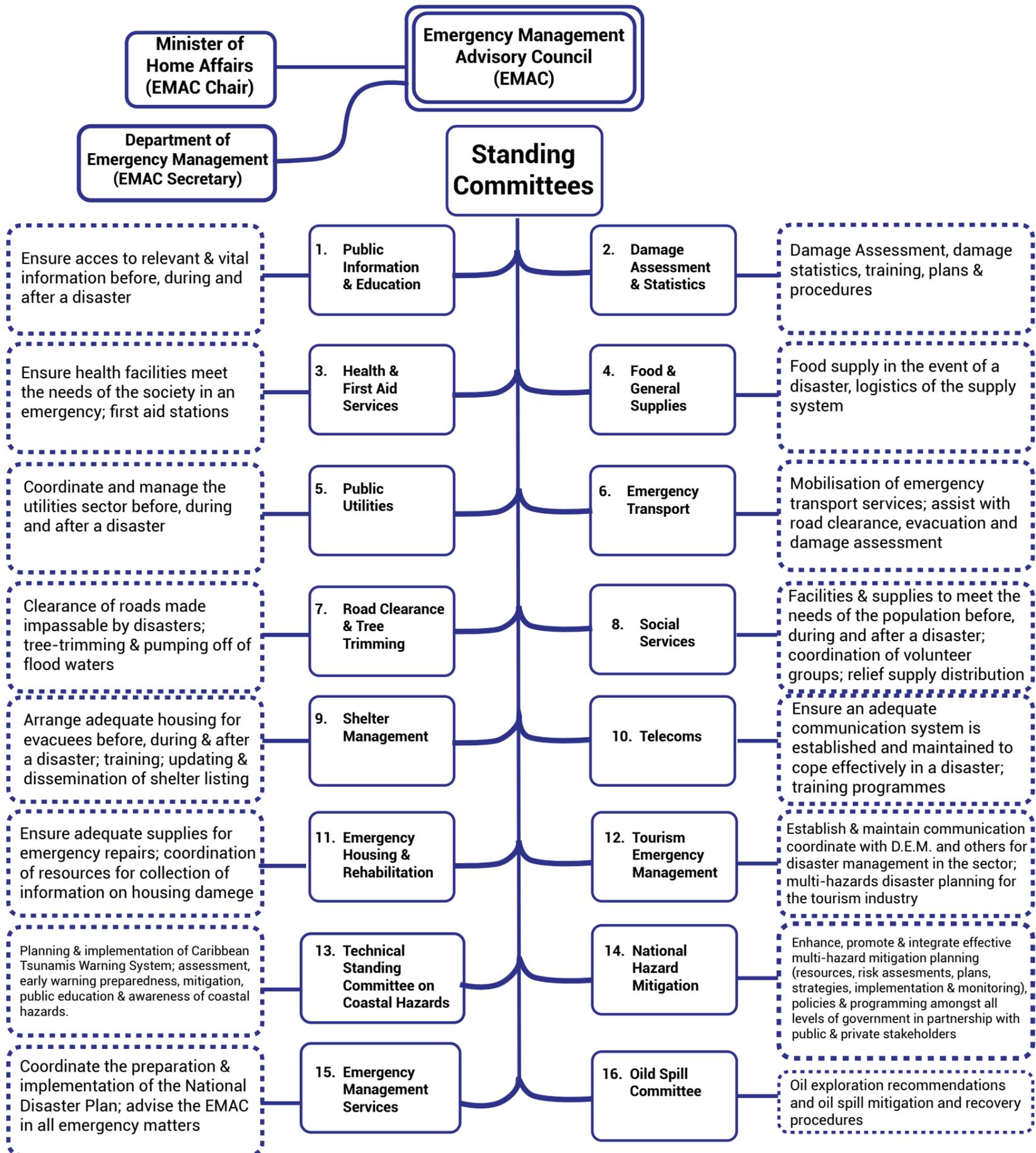
Source: Ministry of People Empowerment and Elder Affairs, 2022

**Table 26: Critical Stakeholders in the DSR Plan and Functions**

STAKEHOLDER		FUNCTIONS
1	Permanent Secretary, Ministry of People Empowerment and Elder Affairs	To convene Meeting of DSRC
2	Permanent Secretary, Ministry of People Empowerment and Elder Affairs	Chairmanship of the Committee; Coordination of operations
3	Chief Welfare Officer Welfare Department	Deputy Chairman of the Committee, coordinate operations at the NEOC
4	Chief Community Development Officer	Coordination of Relief Centres
5	Ministry of Agriculture and Food Security	Food Packs from Minimarts
6	School Meals Department	Cooking and distribution of meals
7	Salvation Army	Preparation of some meals; Provision of clothing
8	St. John Ambulance Association	First Aiders
9	Barbados Red Cross Society	Food, Clothing and First Aid
10	National Assistance Board	Bereavement Services
11	Barbados Evangelical Association	Bereavement Services; Provision of Shelters and post disaster Relief Centres
12	Urban Development Commission	Home Repairs; Short term emergency shelter
13	Rural Development Commission	Home Repairs; Short term emergency shelter
14	Department of Emergency Management	Coordination of District Emergency Organisations (DEOs); Annually assist with the assessment of Relief Centres
15	Child Care Board	Responsible for children in residential care as well as for those children who are not accompanied by parents or guardians in the event of a disaster.
16	Ministry of People Empowerment and Elder Affairs	Mobilisation of Social Workers Across the Public Service
17	Ministry of People Empowerment and Elder Affairs	Provision of training to the relevant responding agencies and opportunities to test plans and procedures.
18	Heads of Departments of MPEA	Compilation of List of social workers in respective agencies
19	Departments of MPEA	Assessment of affected families
20	Royal Barbados Police Force Private/Government Security	Security
21	DEO's / BCBRA	Communication
22	BDF, NAB,NDU,BCD,	Transportation of Vulnerable Persons

# APPENDIX V: Emergency Management Standing Committees

Figure 88: A Schematic of the Emergency Management Advisory Council: Standing Committees Roles and Responsibilities



**Table 27: Representative Standing Committees of the Emergency Management Advisory Council**

COMMITTEE	CHAIRPERSON
Emergency Services Committee	Director, Department of Emergency Management
* Mass Crowd Committee	Commissioner, Royal Barbados Police Force
Public Information and Education	Chief Information Officer, Government Information Service
Damage Assessment and Needs Analysis	Director, Barbados Statistical Services
Health Services Committee	Chief Medical Officer, Ministry of Health and Wellness
Food and General Supplies	Chief Agricultural Officer Ministry of Agriculture and Food Security
Public Utilities Committee	Permanent Secretary Prime Minister's Office Division of Energy and Telecommunications
Road Clearance and Tree Trimming	Chief Technical Officer Ministry of Transport, Works and Maintenance
Emergency Transport	Chief Technical Officer Ministry of Transport, Works and Maintenance
Welfare Services	Chief Welfare Officer Welfare Department
Shelter Management	Chief Education Officer Ministry of Education, Technological and Vocational Training
Telecommunications	Chief Telecommunications Officer Government Telecommunications Unit
Housing & Rehabilitation	Chief Technical Officer Ministry of Housing, Lands and Rural Development
National Mitigation Committee	Chief Town Planner Town & Country Development Planning Office
Tourism Emergency Management Committee	Permanent Secretary Ministry of Tourism and International Transport
Technical Standing Committee on Coastal Hazards	Director, Department of Emergency Management Director, Coastal Zone Management Unit
National Oil Spill Committee	Director Environmental Protection Department

Source: The Department of Emergency Management

\* Note the Mass Crowd Committee is a sub-committee of the Emergency Services Committee.

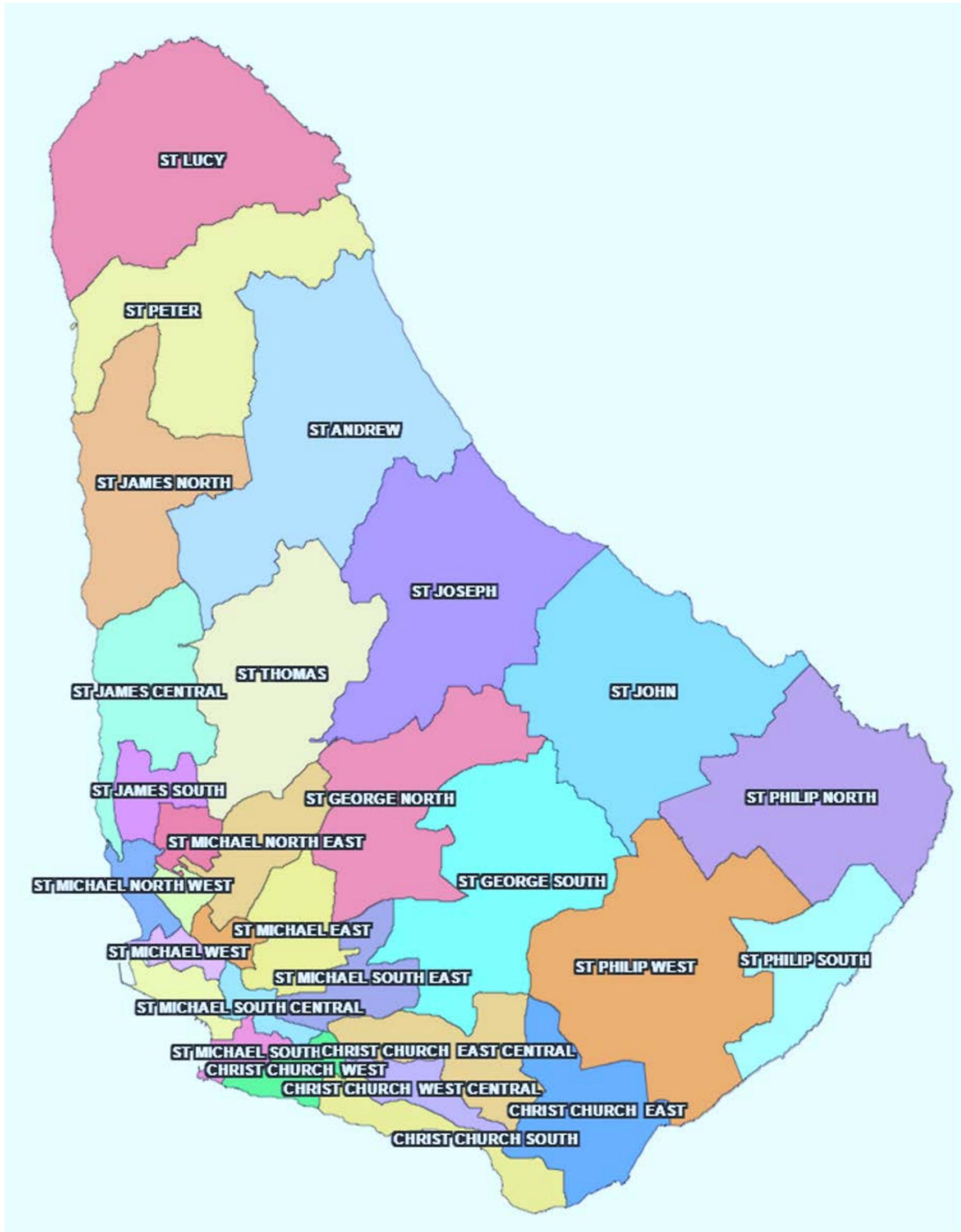
# APPENDIX VI:

## District Emergency Organizations

Across Barbados, there are thirty (30) District Emergency Organizations (DEOs) which coincide with the thirty (30) political constituencies.

- City of Bridgetown
- St. Michael South
- St. Michael East
- St. Michael South Central
- St. Michael Central
- St. Michael South East
- St. Michael North East
- St. Michael North
- St. Michael North West
- St. Michael West
- St. Michael West Central
- Christ Church West
- Christ Church West Central
- Christ Church South
- Christ Church East Central
- Christ Church East
- St. Philip North
- St. Philip South
- St. Philip West
- St. George North
- St. George South
- St. John
- St. Joseph
- St. Thomas
- St. James North
- St. James South
- St. James Central
- St. Peter
- St. Andrew
- St. Lucy

Figure 89: The Constituency Map of Barbados



Source: The Electoral and Boundaries Commission of Barbados

# APPENDIX VII: Priority Sectors

- Agriculture
- Health
- Education
- Tourism
- The Blue Economy
- The Green Economy
- Water Resources
- Energy
- Financial
- Private sector
- National Security
- Cultural Heritage

Cross-cutting Themes are:

- Climate Change
- Gender Responsiveness
- Information and Communication Technologies (ICTs)
- Environmental sustainability

## APPENDIX VIII:

# Legislative Instruments in Support of Environmental Management

Various environmental protection policies, laws and management programmes contribute to the pursuit of Barbados' sustainable development aspiration. Several of these that are particularly relevant and influential in shaping the national climate change and disaster responses are as follows:

- Natural Resources Department of the Energy Division. 1951: Petroleum Winnings Operations Act (obliges licensee to prevent pollution of territorial waters);
- Barbados Water Authority. 1953: Underground Water Control Act (control of use of underground sources);
- Ministry of Agriculture, Food and Fisheries. 1959: Soil Conservation Act (utilisation of lands in the Scotland District);
- Government of Barbados. 1963: Groundwater Protection Zoning Policy (ensures that, by law, any development plan that is deemed to fall within a Zone 1 area is circulated to the BWA and the Environmental Protection Department for their review and comments before the Town and Country Development Planning Office can make a final decision on the matter);
- Ministry of Health. 1969: Health Service Act and Regulation 18 (removal and disposal of refuse);
- Government of Barbados. 1973: Pesticides Control Act 83 (provides for the control of the importation, sale, storage and use of pesticides);
- Government of Barbados. 1974: Pesticides Control Regulations;
- Barbados Water Authority. 1980: Barbados Water Authority Act (management of water resources);
- Fisheries Division, Ministry of Agriculture and Rural Development. 1993: The Fisheries Act (preparation of fisheries management plan, protection of marine life including coral reefs);
- Ministry of International Business and International Transport. 1994: Shipping (Oil Pollution) Act (prevention of pollution by oil);
- Coastal Zone Management Unit. 1998: Coastal Zone Management Act (preservation of marine areas and discharge standards);
- Coastal Zone Management Unit. 1998: Marine Pollution Act (control of marine pollution);
- Town and Country Planning Department. 1998: Town and Country Planning Act (control of built development);
- Government of Barbados. 2002: Draft Policy Framework for Water Resources Development and Management (national strategies and policies are contained in this document);
- Government of Barbados. 2004: National Sustainable Development (NSD) Policy for Barbados (the overarching goal of this policy is to ensure the optimisation of the quality of life for every person by ensuring that economic growth and development does not occur to the detriment of ecological capital);

- Ministry of Agriculture and Rural Development. 2004: Barbados Fisheries Management Plan 2004-2006 (provides longer-term and coordinated management of the key fish species associated with various coastal ecosystems);
- Government of Barbados. 2007: The National Strategic Plan of Barbados 2006-2025 (provides the blueprint for the realisation of Barbados' vision of becoming a fully developed society that is prosperous, socially just and globally competitive by the end of the first quarter of this century);
- Government of Barbados. 2008: Integrated Water Resources Management (IWRM) Roadmap for Barbados (establishes the need for management of water resources and sets foundations for development and preparation of an Integrated Water Resources Management Plan);
- Government of Barbados. 2012: Draft National Climate Change Policy Framework for Barbados (establishes a national process for adapting to climate change effects and minimising greenhouse gas emissions over the short, medium and long term);
- Government of Barbados 2013. The Electric Light and Power Act (relates to the supply and use of electricity and the promotion of electricity generation from renewable energy sources.)
- Moore, W. et al. 2014. Barbados' Green Economy Scoping Study (articulates objectives and strategies in the areas of natural resources management, land use planning, water resources, energy, transport, and disaster management).

# APPENDIX IX: National Initiatives to Address Disaster Risk Management

Table 28: DRM Initiatives in Barbados

Priority Area	Goal	Name of the Initiative	Overall Objective
Institutional Strengthening for Comprehensive Disaster Management (CDM)	The goal of this programmatic area is to pursue programmes and activities that strengthen the enabling environment for Comprehensive Disaster Management (CDM) and encourage the construction of resilient critical infrastructure.	Implementation and Monitoring of the Department of Emergency Management (DEM) Strategic Plan 2019 - 2023	The Strategic Plan 2019-2023 is a shared vision for the field of emergency management and disaster risk reduction in Barbados. It sets an ambitious, yet achievable, path toward advancing emergency management and building resilience across the country for the next five (5) years.
		Relocation of the Department of Emergency Management	The department relocated to a new modern facility at #24 Warrens Industrial Park in July 2020.
		Continued Re-engineering of DEM's Organizational Structure	To build organizational capacity to support the delivery of the DEM mandate.
		Strengthening of the Information Communications Technologies (ICT) Mechanism within the Department to Facilitate Improved Business Processes within the Agency	To upgrade its ICT equipment in an effort to improve its operations and business processes.
		Development of an Updated Comprehensive Disaster Management (CDM) Policy	To facilitate a consultative process via support from CDEMA over the periods October 2020-December 2020 and January 2021 - December 2021. Following stakeholder engagements, a revised policy draft is expected to be submitted to the Emergency Management Advisory Council (EMAC) and the cabinet in 2022.
		National Logistics Policy Document	With the support of CDEMA, facilitate a series of Logistics and Relief Management Workshops to strengthen logistics and relief management in the following thematic areas: incoming relief supplies, port operations, warehousing and storage, transportation management and last mile distribution systems.

Priority Area	Goal	Name of the Initiative	Overall Objective
Institutional Strengthening for Comprehensive Disaster Management (CDM)	The goal of this programmatic area is to pursue programmes and activities that strengthen the enabling environment for Comprehensive Disaster Management (CDM) and encourage the construction of resilient critical infrastructure	The development of the Barbados Comprehensive Disaster Management (CDM) Country Work Programme (CWP) 2019-2023	During 2019, the DEM, with the support of the Caribbean Disaster Emergency Management Agency (CDEMA) and the United Nations Office for Disaster Risk Reduction (UNDRR), completed the Barbados Comprehensive Disaster Management (CDM) Country Work Programme (CWP) 2019-2023. The CWP is a multi-year, results-based programme developed by the partners of the National Emergency Management System (NEMS). Stakeholders agreed on five (5) Programme Areas for work over the next four (4) years. The CWP was officially approved by the Cabinet on January 23, 2020.
		The Development of the Multi-Hazard Early Warning System Roadmap and Action Plan 2021- 2024	With support from CDEMA, implement of the "Strengthening Hydro-Meteorological and Early Warning Services in the Caribbean Project" under the Climate Risk and Early Warning Systems (CREWS) initiative which was funded by the World Bank. Inputs into this project include an assessment report of Barbados' Multi-Hazard Early Warning System (MHEWS) and a National Roadmap and Action Plan for Barbados 2021-2024 following a series of multistakeholder consultations, led by the DEM between the periods March to October 2021.
		Standard Relevant Reviews 2021	The department also conducted a standard review of the Emergency Management Orders 2020 prior to the official start of the hurricane season. This document was then forwarded through The Ministry of Home Affairs and The Office of the Attorney General for final approval by Parliament.
		The Production of the Department's Annual Report	As stipulated by law, the Department submitted its 2020 Annual Report to the Emergency Management Advisory Council for endorsement and later to the Cabinet of Barbados.

Priority Area	Goal	Name of the Initiative	Overall Objective
Preparedness, Response and Mitigation Capacity Strengthening	The goal of this programme is to promote enhanced operational readiness <sup>327</sup> .	Annual Emergency Management Policy and Operational Discussions	To ascertain the state of national preparedness for the upcoming Atlantic Hurricane Season. Such discussions involve various members of the Cabinet, Ministry, department and statutory corporation heads as well as other stakeholders who function in the NEMS.
		COVID-19 Pandemic	To monitor and respond to the threat posed to the nation by the COVID-19 pandemic. The DEM supported the national level COVID-19 planning and response. Support was rendered in the area of plan review, strategic emergency management advice to the Cabinet of Barbados, Ministry of Health led Emergency Operations Centre and by the activation of the DEOs to support information collection and dissemination in communities island wide. The Dem also embarked on an initiative to facilitate the distribution of COVID-19 supplies. The DEM also actively participated in regional level discussions led by CDEMA and CARPHA.
		Emergency Management Sensitisation and Training	To heighten the awareness of public servants to the need for their respective ministries and departments to have written evacuation plans. Such discussions involve various members of the Cabinet, Ministry, department and statutory corporation heads as well as other stakeholders who function in the NEMS.
		Emergency Management Advisory Council meetings	To conduct the Working Meetings of the EMAC (in-person or virtually).
		Draft National Hazard Mitigation Policy	To draft a national policy and present it to the EMAC.
		Technical Services to the EMAC Technical Standing Committees and other National Level Multi-Agency Committees	To coordinate activities with the National Emergency Management System's EMAC and its sixteen (16) standing committees in efforts to sensitize the public to the types of hazards to which they are prone so that they can better prepare for them.

<sup>327</sup> This will be achieved via a sustained National Emergency Management System; an approved, tested and updated National Emergency Management Plan and related procedures; enhanced first responder capacities; as well as the mainstreaming and strengthening of CDM knowledge and capabilities within the entire national system.

Priority Area	Goal	Name of the Initiative	Overall Objective
Preparedness, Response and Mitigation Capacity Strengthening	The goal of this programme is to promote enhanced operational readiness <sup>328</sup> .	Refinement and Approval of National Emergency Management Plan Components	To refine and to seek approval on the National Emergency Management Plans and Standard Operating Procedures from the designated National authorities and ultimately, the Cabinet of Barbados particularly in the context of the COVID-19 pandemic via a series of National Curfew Directives.
		The Management of Mass Crowd Events	To support the congregation of persons resulting from planned or unplanned mass crowd events via emergency management planning and response support.
		Common Alerting Protocol (CAP)	To ensure that the enhanced public warning and alerting network facilitates automated integration with the DEM's social media networks therefore allowing for the synchronized dissemination of emergency alerts across various social media platforms.
		Exercising of Plans and Procedures	<ul style="list-style-type: none"> <li>• National Oil Spill Exercise</li> <li>• Exercise Region Rap 2020</li> <li>• Caribe Wave 2020</li> <li>• National Exercise 2019-2020</li> <li>• Exercise SYNERGY 2020</li> <li>• Damage Assessment and Needs Analysis (DANA)</li> <li>• Exercise Montgomery</li> </ul>
		Signing of Memorandum of Understanding (MOU) -Roving Response Team	To solidify a twenty-seven (27) year partnership with the Roving Response Team (RRT).
		Signing of Memorandum of Understanding (MOU) - Food and General Supplies Committee	To solidify a partnership chaired by the Ministry of Agriculture and Food Security with various private sector distribution centres aimed at increasing their quantities of stock on island during the Atlantic hurricane season.

328 This will be achieved via a sustained National Emergency Management System; an approved, tested and updated National Emergency Management Plan and related procedures; enhanced first responder capacities; as well as the mainstreaming and strengthening of CDM knowledge and capabilities within the entire national system.

Priority Area	Goal	Name of the Initiative	Overall Objective
Strengthening Community Resilience	The goal of this programme is to empower communities across Barbados to be more resilient <sup>329</sup> .	Tsunami Ready Programme	To ensure the good maintenance of adequate signage at strategic points along coastlines - particularly along the South Eastern and North Western coastlines.
		DEM – District Emergency Organisations (DEOs) Interface	To conduct a series of training workshops aimed at building capacities within administrators across different community groups as demarcated by the national political constituencies
		Continued Sensitization and Updating of the National Volunteer Registry	To sensitize the public of the National Volunteer Registry and the role played during the hazardous events and disasters as it relates to community response.
		Community Plan Focus Exercise	<ul style="list-style-type: none"> <li>To orientate the volunteer arm of the DEM, DEOs and community leaders on the Barbados National Response Mechanism (BNRM) and how it relates to the district and community levels;</li> <li>To sensitize the volunteer arm of the DEM, DEOs and community leaders on the disaster planning and plan development processes;</li> <li>To discuss and introduce participants to the disaster planning framework and developing district disaster contingency plans and Standard Operating Procedures (SOP);</li> <li>To enhance the capacity of participants in the principles of testing disaster plans, the five (5) types of exercises and designing exercises to test plans and procedures</li> </ul>
		DEO Stalwart Recognition	To highlight the achievements and contributions of national volunteers in disaster resilience efforts. This activity is part of the DEM's commemoration of the UN Volunteer Day.
Strengthening Community Resilience	The goal of this programme is to empower communities across Barbados to be more resilient <sup>330</sup> .	The National "Give Back Programme"	To allow students of the UWI to volunteer at the department and be given "credit" for their participation. During the year the department was engaged by the COVID-19 Implementation Unit to assist with the Community Intervention with the Elderly, eight (8) students were given the opportunity to participate and gain credits. This was a community outreach administered to the elderly via telephone to gather information on their social and health situations. Members of the DEOs also participated in this activity.

329 This will include strengthened community mitigation, preparedness and response, as well as the sustainment of community livelihoods through effective risk management. In addition, the programme is to strengthen the human resource capacity of DEM, emergency response personnel and community volunteers through targeted training and development programmes

330 This will include strengthened community mitigation, preparedness and response, as well as the sustainment of community livelihoods through effective risk management. In addition, the programme is to strengthen the human resource capacity of DEM, emergency response personnel and community volunteers through targeted training and development programmes

Priority Area	Goal	Name of the Initiative	Overall Objective
Research and Knowledge Management	The goal of this programme is to increase and sustain research, knowledge management and learning for comprehensive disaster management (CDM) <sup>331</sup> .	Human Resources Strengthening	To promote capacity building across its technical experts via several virtual training courses, seminars and workshops in various topic areas in DRM as well as Commitment for Results Planning, Logistics Planning and Management, Negotiations and Performance Development
		Public Awareness, Information and Education	To provide information to improve public understanding and increase knowledge sharing on priority hazards at the community and household levels. This is achieved via the implementation of a Social Media and Visibility Strategy and Plan for 2020-2023 which employs the use of various types of media: print media, social media and radio transmissions.
		Mainstreaming of Emergency Management in Curriculum/ Training Schedule of the Public Service and Locally based Tertiary Institutions	To conduct Liaison Officer Training intervention was held to orient and or re-orient over seventy (70) Public Officers and other stakeholders in respect of their roles within the NEMS under a CDM framework. The objective of which was to allow for a more inclusive and synchronised approach to emergency planning and response.
		Coastal Hazards and Earthquake Smart Month	To facilitate a month of activities during March to commemorate Coastal Hazards and Earthquake Smart Month with support from the Coastal Zone Management Unit and Technical Standing Committee on Coastal Hazards. Activities included a Movie Night, a Caribe Wave Exercise, a Run Tsunami Run 5K Walk and Run, a Carpool chat and the National Earthquake Preparedness Day.
Research and Knowledge Management	The goal of this programme is to increase and sustain research, knowledge management and learning for comprehensive disaster management (CDM).	Hurricane Awareness Month	<ul style="list-style-type: none"> <li>To further sensitize the Barbadian public, inclusive of disabled communities, to the hurricane hazard and its associated secondary hazards such as storm surge and flooding;</li> <li>To orient the population on the role of the DEM while showcasing the good practices and achievements of the department;</li> <li>To recognise and promote the work of the DEM's volunteer arm and DEOs;</li> <li>To continue to foster linkages with the private sector.</li> </ul>
		Social Media Activities and Events	To coordinate activities with a social media focus under the Public Awareness and Education Programme. Activities sought to engage the public on was to adapt/cope in extreme events, to promote an understanding of coastal hazards and earthquakes as well as hurricane and tsunami preparedness, to sensitize the public on UN designated days/holidays via informative campaigns.

331 This includes the development and expansion of data and information management systems; the creation, maintenance and upgrading of social media platforms; the expansion of risk knowledge for disaster risk reduction and climate change adaptation; applied disaster and risk related information for regulations and decision-making; and knowledge enhancement of the National Emergency Management System stakeholders inclusive of internal DEM staff, emergency services, private sector, public sector, community based organisations, non-governmental organisations and the general public about the various hazards will be achieved through the continued delivery of public education and public awareness programmes, focusing on multi-hazards, with special enhancement of Information Communication Technologies (ICT).

Priority Area	Goal	Name of the Initiative	Overall Objective
Recovery	The goal of this programmatic area is to pursue programmes and activities that lead to an enhanced national recovery framework <sup>332</sup> .	Contingent Credit Facility for Natural Disaster (sic) Emergencies (CCF)	To spearhead the implementation and monitoring of three of the triggers/indicators agreed to in the Comprehensive Natural Disaster Risk Management Program (CNDRMP) via support from the Inter-American Development Bank.
		Recovery Operations for 2021 Emergency Events	To facilitate recovery actions were required in the aftermath of the significant ash fall event experienced in April 2021, the Freak Storm in June 2021, Hurricane Elsa in early July 2021 and the ongoing COVID-19 Pandemic. Such actions were largely focused on social protection and housing rehabilitation efforts post Freak Storm and Hurricane Elsa, clean-up campaigns post ash fall and post cyclone, and the revision of policies, plans and procedures to improve emergency management efforts going forward.

<sup>332</sup> The Recovery Framework seeks to achieve a shared understanding and a common, integrated perspective on Recovery in order to achieve unity of effort and make the most effective use of the country's limited resources. It considers and promotes social, environmental infrastructural and economic recovery. Focus is placed on the development and exercising of Continuity of Government Plans; development and application of model Business Continuity Plans; policy and procedures for accessing the Catastrophe Fund; as well as a strengthened Psychosocial Support Programme.

Priority Area	Goal	Name of the Initiative	Overall Objective
External Relations	The goal of this programme is to actively promote cooperation and collaboration between Barbados and external partners, with a view of advancing the national disaster risk management programme <sup>333</sup> .	World Meteorological Organisation (WMO) – Climate Risk and Early Warning Systems (CREWS)	To conduct a three-year project that seeks to strengthen and streamline regional and national systems and capacity related to weather forecasting, hydrological services, multi-hazard impact-based warnings and service delivery for enhanced decision-making in the Caribbean – particularly amongst CARICOM Member States. Led by the World Bank Global Facility for Disaster Reduction and Recovery GFDRR), the project targets both regional and national level priority areas to comprehensively strengthen hydromet services and Early Warning Systems (EWS) across the region.
		Inter-American Development Bank (IDB) – Government of Barbados Sustainable Development Policy Programme/Contingent Loan for Natural Disaster (sic) Emergencies (BA - L1048 & BA - 00004)	To participated in a series of meetings on the initiative to pursue IDB Policy based Loans for Barbados as well as the Contingent Credit Facility. The department also produced and submitted progress reports on the DEM-led obligations under these policy programmes and loan arrangements.
		Inter-American Development Bank (IDB) – Government of Barbados Technical Co-operation Programme (BA-T1068)	To promote technical cooperation at the international level which focused on improving institutional frameworks for integrated coastal zone management, national risk management planning systems and sustainable climate resilient coastal infrastructure.
		Barbados – UNESCO IOC Intergovernmental Coordination Group (ICG) – Caribbean Tsunami Information Centre (CTIC)	To provide technical support in the areas of tsunami disaster risk reduction across Tsunami prone areas in Barbados (North Western and South Eastern coastlines)
		Barbados – United Nations Relations: UN Environment/ OCHA Environmental Emergencies Centre <sup>334</sup>	To participate in monthly Environmental Emergencies Network Meetings which focused on capacity building and developmental opportunities for Network members, establishing rules of operations of the Network, work programme implementation and reporting with respect to environmental emergencies network’s agreed to priorities.

333 Historically, the Ministry of Foreign Affairs has played a facilitating role in this area and it is envisaged that it would continue as necessitated. The DEM sees it necessary to continue strengthening bilateral relationships with regional and international partners, in an effort to enhance capacity to address matters relating to emergency management and information sharing by experts.

334 The UN Environment Programme (UNEP)/UN Office for the Coordination of Humanitarian Affairs (OCHA) Joint Environment Unit (JEU) was established in 1994 as the United Nations mechanism to mobilise and coordinate emergency assistance to countries affected by environmental emergencies and disasters with significant environmental impact. The Joint Unit mobilises technical expertise to deploy to emergencies and also works on readiness for response and risk reduction, primarily through knowledge sharing, trainings and the development of tools and guidance.

Priority Area	Goal	Name of the Initiative	Overall Objective
External Relations	The goal of this programme is to actively promote cooperation and collaboration between Barbados and external partners, with a view of advancing the national disaster risk management programme.	Barbados – Caribbean Disaster Emergency Management Agency (CDEMA)	To make an annual contribution to CDEMA as a Participating State and in return directly benefit from disaster management technical assistance projects, resource mobilisation and support during a hazardous impact.
		Regional Security System (RSS)	To facilitate the participation of DEM and other NEMS agencies in a RSS table top exercise focused on national and regional emergency response systems.
		DEM - US Military Liaison Office (MLO)	To develop proposals under the Humanitarian Assistance Programme and the Minimal Cost Project Programme. These projects sought to acquire additional equipment for emergency operations and the installation of shutters at an emergency shelter.
		Courtesy Call and Technical Exploratory Meetings	To actively participate in a series of Courtesy Calls and Technical Exploratory Meetings at the national, regional and international levels.
		Donations to Support COVID-19 Response	To receive the donation of Personal Protection Equipment (PPE) from the Jack Ma Foundation, Caribbean Development Bank (CDB), World Health Organization (WHO) and United Arab Emirates (UAE). These donations were facilitated through the CDEMA with the sole purpose of assisting the DEM in its fight against the COVID-19 Pandemic.
		United States Embassy Military Liaison Office (MLO)/ Barbados Relations	To be earmarked as the venue for Tradewinds 2021. Tradewinds is a US Southern Command sponsored Caribbean focused training exercise designed to help participants better respond to disasters and land and maritime threats. The exercise includes U.S. military and Security agency personnel who will train with counterparts from twenty-one partner nations.
		DEM – Caribbean Institute for Meteorology and Hydrology (CIMH) Relations	To collaborate on disaster management initiatives across the Caribbean Basin.
		DEM-Barbados Canada Association (BCA) Relations	To solidify a partnership between the DEM and the Barbados Canada Association via the signing of a Memorandum of Understanding (MOU) to garner support on matters related to disaster risk management and humanitarian assistance.
		Barbados – Martinique	To facilitate technical assistance across Caribbean Member States and leverage inherit knowledge regarding the hazards posed during volcanic eruptions.
Barbados – Columbia	To discuss technical cooperation between the two (2) countries with a focus on DRM.		

# APPENDIX X: Disaster Risk Reduction Interventions and Capacities for Priority Area 2 under the Sendai Framework for Disaster Risk Reduction

## Priority 2: Strengthening Disaster Risk Governance to Manage Disaster Risk

### Guiding Principles for Comprehensive Disaster Management

- A CDM approach that addresses 'all-phases' of disaster management - mitigation, preparedness, response, and recovery; all natural and man-made hazards - including those related to climate change and climate variability; and that aims to build resilience of 'all-people' including the public and private sectors, all segments of society including civil society.
- A resilience approach that is timely efficient and is able to leapfrog in a quick manner that reduces susceptibility to the impact of the same hazard.
- Promotion of sustainable development through the reduction of disaster risks and vulnerability of society to natural and man-made hazards.
- Integrated of CDM in all national development plans and instruments and at all levels of everyday activity by the entire society.
- Risk assessment is incorporated in all aspects of the national development planning process from visioning, problem definition, goal, strategy and solutions articulation.
- Stakeholders understand their role and share responsibility with the National Disaster Office for managing disaster risk.
- Promotion of an evidence-based, systematic, and consistent approach for risk assessment, planning and management.
- Decision making is proactive, consultative, and participatory.
- All levels of government are committed to continuous improvement of policy, programs, practices, lessons learning and service delivery to improve community safety.
- ICTs are utilized for knowledge sharing, information management, and large-scale transformation.
- Governance arrangements and capacity for key players is adequate – communities, government, and the private sector to reduce risk and deliver the CDM programme.

**Table 29: Initiatives aimed at enabling sustainable agricultural development in Barbados**

Area	Legislation
<b>New/Upgraded legislation – Institutional capital enhancement</b>	<p>Plant Protection Act (2007)</p> <p>Animals (Disease and Importation) Act (1999)</p> <p>Plant Varieties Protection Act (2001)</p> <p>Fisheries Act (2000)</p> <p>Markets and Slaughterhouse Act (under revision)</p> <p>Soil Conservation and Scotland District Act (1998)</p> <p>National Parks Act (1998)</p> <p>Town and Country Planning Act (2007)</p> <p>Cane Fires Prevention Act (1995)</p>
<b>Fiscal incentives to spur production</b>	<p>A rebate of US\$ 500 per hectare for the return of idle land for cotton production - applicable to farms 0.2 to 2.0 hectares</p> <p>A rebate of US\$ 250 per hectare for the return of idle land for cotton production - applicable to farms over 8.0 hectares</p> <p>A rebate of 50% on the cost of certification as an organic cotton farm</p> <p>A technical assistance fund of US\$ 500 000 to assist producers, processors and investors in areas of feasibility studies and market research</p> <p>A rebate of 50% on the cost of establishing an approved irrigation system to a maximum of US\$ 72,000 where two or more farmers share common facilities</p> <p>A rebate of 75% on the cost of establishing an approved irrigation and mulching system - applicable to registered agricultural cooperatives and farmers' organizations</p> <p>A subsidy of US\$ 500 per hectare to registered farmers to assist in defraying the cost of returning idle land to production</p> <p>A rebate of 50% for the components of an approved environmental control system for poultry and livestock facilities up to a maximum of US\$ 25,000 per unit</p>
<b>New crop technology</b>	<p>A rebate of 40% on the cost for the components of greenhouses and hydroponic systems for crop or horticultural production up to a maximum of US\$ 30,000 in order to stimulate the investment in proven technology that can lead to increased productivity</p> <p>A rebate of 30% on the cost of an extended life weed fabric or any other mulch system up to a maximum of US\$ 2,000 per hectare, whichever is the lesser</p> <p>A rebate of 25% on the cost of the components of greenhouses and hydroponics systems for crops or horticultural production up to a maximum of US\$ 250,000 per cooperative/partnership</p> <p>Provision of US\$ 2,000,000 through the Agricultural Development Fund to establish a pilot project at the Home Agricultural Station for research, production and training in agricultural practices such as greenhouses and hydroponic systems</p> <p>A rebate of 50% on the costs of the management of trees purchased at discount price in accordance with the guidelines of the Ministry of Agriculture</p> <p>A grant of US\$ 5.00 per approved fruit tree for a maximum of 1,000 trees per holding located within the boundaries of the Scotland District</p> <p>A 50% discount for the purchase of a minimum of 300 trees of approved species from the Ministry of Agriculture</p>
<b>Resource protection and management</b>	<p>A rebate of 30% on the cost of the establishment of approved soil conservation measures up to a maximum of US\$ 5,000</p> <p>A rebate of 30% on the cost of the design and construction of biogas digesters up to a maximum of US\$ 3,500 per holding to mitigate the effect of livestock production on Barbados' ground water supply, and to promote a mechanism for recycling wastewater, gas, and organic slurry</p>
<b>Organic farming</b>	<p>A rebate of 50% on the cost of the certification of organic farms up to a maximum of US\$ 2,000 per farm. Where two or more farmers collaborated to achieve international organic certification a grant of 60% of the cost of certification up to a maximum of US\$ 10,000 will be provided</p> <p>A rebate of 30% on the cost of approved organic inputs made from local materials, up to a maximum of US\$ 500 per hectare. The range of products include compost, pesticides, mulches, planting material, fertilizers, soil ameliorants, and compost using local material made available to a registered farmer's organization or agricultural cooperative upon submission of an acceptable business plan</p> <p>A technical assistance fund of US\$ 100,000 to facilitate the development of organic production in Barbados through, inter alia, the development of an internationally acceptable protocol for certification of organic farming in Barbados</p>

Source: Moore et al., 2014

**Table 30: Varied Housing Strategies and programmes on the island of Barbados**

Housing Strategy and Programmes	Rationale
<b>H.E.L.P (Housing Every Last Person)</b>	<p>The 'Housing Every Last Person' (HELP) programme places emphasis on providing a greater number of housing solutions to low income earners to meet the ever-increasing demand. The cost of the houses is projected to range from \$130,000.00 to \$175,000.00. The houses are of stone and timber comprising two (2) and three (3) bedrooms with sizes varying from 476 to 820 square feet. At the end of 2009, 182 houses were completed in the following areas:</p> <ul style="list-style-type: none"> <li>• Marchfield, St. Philip</li> <li>• Workhall, St. Philip</li> <li>• Draxhall/ Greens, St. George</li> <li>• French Village, St. Peter</li> <li>• Four Hill, St. Peter</li> </ul>
<b>Zero Lot Line Concept</b>	<p>This concept is for single-family dwellings, designed to promote more efficient land use; permit a more energy efficient arrangement of structures; provide more usable community open space; and reduce perimeter land space/cartilage resulting in less maintenance cost and less initial land cost. This design approach is being piloted as part of a joint public/private sector partnership at Coverley Plantation. The development is marketed as the "Villages at Coverley". The Government in this instance has provided approximately 103 acres (41.16ha) of land and importation concessions while the private sector has provided all other inputs.</p>
<b>Starter Homes</b>	<p>The Government is promoting the concept of starter home projects and partnerships with private sector companies (through tax incentives) in advancing the concept of "build and live", a Barbadian tradition.</p>
<b>Housing Solutions</b>	<p>The GoB is committed to building 2,000 housing solutions per year, inclusive of rental units and starter homes.</p>
<b>Low- and Middle-Income Housing</b>	<p>The provision of 2,500 house spots for sale to low- and middle-income wage earners.</p>
<b>Assisting the needy</b>	<p>This programme represents the Government's commitment to building and maintaining a pool of rent-to-purchase units for low-income earners, pensioners, and the disabled who may not qualify for mortgages and loans.</p>
<b>500 Lot Programme</b>	<p>The GoB in 2008 outlined an initiative to provide 500 lots in five months at \$5 per square foot for first time homeowners. During 2009, lots were identified, and the process of acquisition and development was initiated. At the end of that year, infrastructural works had begun on 253 lots at sites located in St. Thomas, St. Philip, St. George, St. Joseph and St. Lucy.<sup>335</sup></p>
<b>Rent to Own Programme</b>	<p>During the period 2008 – 2009, the Cabinet of Barbados considered and approved a recommendation from the Ministry of Housing and Lands to provide a viable option for persons who otherwise would not qualify for a solution under the HELP programme; hence the launch of the "RENT TO OWN" programme. These persons earn less than three thousand (\$3000) dollars monthly and thus do not qualify for mortgages to purchase the most basic house being built under the programme. The main objective of the programme is to allow low income earners the opportunity to become property owners. Rent to own, was a contractual agreement between a tenant and a landlord for a period of seven (7) years in the first instance. At the end of the seven (7) years, a purchase contract would be executed once the tenant exercises the option to purchase. In the event the tenant does not exercise the option to purchase at the end of seven (7) years, the rental arrangement may be extended for a further two (2) years. The Rent-to-Own Programme was inaugurated in 2009. Sixteen (16) houses constructed at Airley Heights were used to pilot the programme. To date, thirteen (13) families have benefited from the programme.</p>
<b>Transfer of Terrace Units</b>	<p>Under the Sale of Terrace Units programme, the tenants of the National Housing Corporation (NHC) residing in their rental units for 20 years or more are given the opportunity to own their units free of cost. Beneficiaries will only have to pay the legal fees. The aim of this programme is to transform tenants into owners and expand the base of property ownership within the low-income grouping. At the end of the review period, 827 deposits, in addition to twenty-six (26) 100% mortgages were made, totalling \$3.4 million. Between 2008 and 2009, 266 units were sold. During the same period, 2,161 offer letters were forwarded to qualified tenants and occupants, of which 569 tenants had previously made deposits to purchase units. Some 1,926 or 90.0% of the tenants and occupants have accepted the offer. Approximately \$630,000 in arrears, was collected from tenants and occupants responding to the offer of free transfer.</p>

Source: Moore et al., 2014

335 Ministry of Economic Affairs, Empowerment, Innovation, Trade, Industry and Commerce. 2010. Barbados Economic and Social Report 2009. p71.

**Table 31: Regulatory Agencies in Barbados with shared responsibility for Policy Implementation in Buildings and Infrastructure**

Department/Ministry	Main responsibilities	Legislation
Town and Country Development Planning Office, Prime Minister's Office	<ul style="list-style-type: none"> <li>Building development and engineering works on all lands (including change of use and subdivision of land) within the island and within the territorial waters of Barbados, including all coastal and marine development within the 200 nautical mile territorial limits.</li> </ul>	<ul style="list-style-type: none"> <li>Town and Country Planning Act Cap 240</li> <li>Town and Country Planning Development Order 1972</li> <li>Preservation of Trees Act 1981</li> </ul>
Ministry of Transport and Works	<ul style="list-style-type: none"> <li>Registration of building practitioners;</li> <li>Development of necessary policies and legislation are developed;</li> <li>Development of effective programmes for the construction and maintenance of public infrastructure; and</li> <li>Establish, improve and maintain building standards</li> </ul>	<ul style="list-style-type: none"> <li>Public Works Act CAP 32</li> </ul>
Barbados Water Authority	<ul style="list-style-type: none"> <li>Exclusively responsible for the provision of potable water across the island</li> </ul>	<ul style="list-style-type: none"> <li>Underground Water Control Act Cap 283</li> <li>Barbados Water Authority Act Cap 274</li> </ul>
National Housing Corporation	<ul style="list-style-type: none"> <li>Provide affordable housing solutions, including the administration of: <ul style="list-style-type: none"> <li>Rentals (units; lots; office spaces/properties)</li> <li>Sale of land and property (of Land; auctions (when a buyer is in default)</li> <li>Sale of Terrace Units (tenants occupying the unit for more than 3 years are eligible to purchase; tenants occupying the units for more than 20 years must cover legal costs only)</li> <li>Loans (chattel mortgage; legal mortgage; promissory note)</li> </ul> </li> <li>Transfer of title under the Tenancies Freehold Purchase Act</li> <li>Maintenance of housing units</li> </ul>	<ul style="list-style-type: none"> <li>National Housing Corporation Act 1973</li> </ul>
Drainage Division, Ministry of Environment, Water Resources	<ul style="list-style-type: none"> <li>Establish, implement and sustain an effective and efficient drainage management and flood prevention programme with the objective of mitigating and alleviating the flood challenges countrywide</li> </ul>	<ul style="list-style-type: none"> <li>Prevention of Floods Act – 1951 (CAP 235)</li> <li>Prevention of Floods (Amendment) Bill – 1992</li> <li>Prevention of Floods (Amendment) Act 1996-12</li> <li>Highway Act (CAP 289)</li> </ul>
Government Electrical Engineering Department	<ul style="list-style-type: none"> <li>Regulate electrical supply to all installations in Barbados</li> </ul>	
Barbados Fire Service	<ul style="list-style-type: none"> <li>Fire prevention island-wide</li> </ul>	<ul style="list-style-type: none"> <li>Fire Service Act Cap 163</li> </ul>
Environmental Protection Department, Ministry of Environment and Drainage	<ul style="list-style-type: none"> <li>Monitoring and control of conditions likely to affect the quality of and, air and water and the general health and environmental wellbeing of the inhabitants of Barbados.</li> </ul>	<ul style="list-style-type: none"> <li>Health Services Act 1969</li> <li>Health Services Regulations</li> <li>Building Regulations 233/1969</li> </ul>
Urban Development Commission, Ministry of Social Care, Constituency Empowerment, Urban and Rural Development	<ul style="list-style-type: none"> <li>Provision of social and infrastructural amenities to the urban poor;</li> <li>Promotion of healthy community life</li> </ul>	<ul style="list-style-type: none"> <li>Urban Development Commission Act 1997</li> </ul>
Sanitation Services Authority	<ul style="list-style-type: none"> <li>Removal of solid waste from homes island wide and government agencies</li> <li>A commercial arm which offers a paid service to the private sector for the moving of waste</li> </ul>	<ul style="list-style-type: none"> <li>Sanitation Services Authority Act Cap 382</li> </ul>

Source: Moore et al., 2014

## Transportation Sector

**Table 32: A Summary of Regulatory Agencies with Responsibilities for the Transportation System**

Department/Ministry	Main Responsibilities	Legislation
<b>Transport Authority</b>	To plan, monitor and regulate the public transport system: Main functions are: <ul style="list-style-type: none"> <li>To issue, cancel, suspend licenses of drivers and conductors of public service vehicles</li> <li>To issue, suspend or revoke permits in respect of public service vehicles</li> <li>To restricts the use of motor omnibuses, minibuses and route taxis to specified routes</li> <li>To regulate and restrict the number of motor omnibuses minibuses and route taxis on specified routes</li> <li>To supervise the conduct of business in the passenger terminals</li> <li>To publish current information on public transport services to establish timetables to be observed by drivers and conductors of motor omnibuses minibuses and route taxis</li> <li>To determine the sitting of lay-by and the location of bus stops for the picking up and setting down of passengers using motor omnibuses, minibuses and route taxis</li> </ul>	<ul style="list-style-type: none"> <li>Transport Authority Act 2007-28</li> </ul>
<b>The Drainage Division Ministry of Environment, Water Resources</b>	This department seeks to establish, implement and sustain an effective and efficient drainage management and flood prevention programme with the objective of mitigating and alleviating the flood challenges countrywide	<ul style="list-style-type: none"> <li>Prevention of Floods Act – 1951 (CAP 235)</li> <li>Prevention of Floods (Amendment) Bill – 1992</li> <li>Prevention of Floods (Amendment) Act 1996-12</li> <li>Highway Act (CAP 289)</li> </ul>
<b>Government Electrical Engineering Department</b>	To regulate electrical supply to all installations in Barbados	<ul style="list-style-type: none"> <li>Underground Water Control Act Cap 283</li> <li>Barbados Water Authority Act Cap 274</li> </ul>
<b>Environmental Protection Department, Ministry of Environment and Drainage</b>	This department is responsible for the monitoring and control of conditions likely to affect the quality of land, air and water and the general health and environmental well-being of the inhabitants of Barbados. Its functions are exercised throughout the entire island.	<ul style="list-style-type: none"> <li>Health Services Act 1969</li> <li>Health Services Regulations.</li> </ul>
<b>Rural Development Commission</b>	To facilitate road improvement and the lighting of streets in rural districts of Barbados	Rural Development Commission Cap 238
<b>Town and Country Development Planning Office, Prime Minister's Office</b>	This department has responsibility for all building, engineering works on all lands within the island and within the territorial waters of Barbados. This therefore includes all coastal and marine development within the 200 nautical mile territorial limits.	<ul style="list-style-type: none"> <li>Town and Country Planning Act Cap 240</li> <li>Town and Country Planning Development Order 1972</li> <li>Preservation of Trees Act 1981</li> </ul>
<b>Ministry of Transport and Works</b>	The construction and maintenance of all government roads, bridges and buildings as follows: <ul style="list-style-type: none"> <li>To plan, design and develop a comprehensive road network system;</li> <li>To provide policy guidelines, planning and technical services in the areas of traffic management, works and electrical services;</li> <li>To plan, design, construct and maintain public buildings;</li> <li>To develop, regulate and maintain the road transport and ancillary facilities conducted through the Licensing Authority and the Barbados Transport Authority and private operators and the provision of support services;</li> <li>To ensure that necessary policies and legislation are developed;</li> <li>To develop effective programmes for the construction and maintenance of public infrastructure; and</li> <li>To establish, improve and maintain building standards</li> </ul>	<ul style="list-style-type: none"> <li>Public Works Act CAP 32</li> <li>Highway Act (CAP 289).</li> </ul>
<b>Ministry of Housing and Lands</b>	Functions include the acquisition of land for the purpose of infrastructural improvement.	Land Acquisition Act CAP 228
<b>Royal Barbados Police Force</b>	Responsibilities include the enforcement of laws and regulations to ensure road safety for all users – vehicular, cyclists, pedestrian.	All relevant legislation

Source: Moore et al., 2014

**Table 33: Urgent Strategic Imperatives promoting Disaster Risk Governance in the Tourism Sector**

Imperative	Strategy	Action	Indicators	Timeframe
<b>Improve the Transportation of People on Land and Near-Shore</b>	8.1 Streamline the movement of people on land and in near-shore waters through enhanced infrastructure, products and services	8.1-1 Establish a Traffic and Transport Task Force	Traffic and Transport Team established, and Highways 1 and 7 assessed, with recommendations for improvement completed	2015;ongoing
<b>Assure Safety &amp; Security of Visitors &amp; Residents</b>	9.1 Boost the capacity of the security forces to assure the safety of all visitors and residents	9.1-1 Establish a Rapid Response Team for Visitor Safety Issues	Rapid Response Task Force established, and recommendations for improvement of safety and security made	2015;ongoing
<b>Mainstream Environmental Management</b>	11.1 Bring environmental management into the mainstream through improved protected area management and enhanced physical environs, implementation of conservation initiatives, and expanded capacity to provide environmental education and public awareness	11.1-1 Implement a Beach Accreditation Programme	Beach accreditation programme launched	2015;ongoing
<b>Update and Enforce Policy and Legislation to Support the BVE</b>	12.1 Review existing legislation to identify gaps and enforcement measures, and enact new laws to support the functioning of the BVE	12.1-1 Ratify the Draft Environmental Management Act	Draft Environmental Management Act ratified	2014
		12.1-2 Develop an Incentives Approach through Policy and Legislation	Senior level forum conducted and programme established	2015

Source: Government of Barbados, 2014

**Table 34: Sustaining Strategic Imperatives promoting Disaster Risk Governance in the Tourism Sector**

Imperative	Strategy	Action	Indicators	Timeframe
Base decisions on comprehensive, accurate, and timely data/information	1.1 Foster information-based decision-making through up-to-date research which is coordinated and integrated across the various stakeholder groups, and provide well archived, easily retrievable documentation which can support the BVE	1.1-4 Create and Operate a Central Repository and Portal for Visitor Research Management	Central repository and portal created and fully integrated and operated by MTI	2016-2017
	1.2 Promote ongoing monitoring of the BVE within the wider regional and global environment to evaluate Barbados performance against best practice in order to position it for enhanced competitiveness	1.2-2 Obtain Feedback on Visitor and Local User Experience	Baseline and ongoing feedback from 10% visitors and 2% locals on their perspectives of tourism products and services	2015;ongoing
Enhance the visitor experience	2.2a Improve and enhance the inventory of built heritage attractions and their associated services to entice visitor interest and promote increased visitor spending	2.2a-4 Revitalize Historic Oistins as a Heritage Centre	Infrastructure and amenities in Oistins developed and improved that promote Barbados	2014-2022
	2.2b The UNESCO designated World Heritage Site of Historic Bridgetown and its Garrison is a critically important part of the Barbados cultural heritage that needs to be further developed to attract visitors to the capital and its environs, thereby revitalizing Bridgetown and promoting increased economic activity	2.2b-1 Maintain the UNESCO World Heritage Designation for Bridgetown and Its Garrison	Annual maintenance of the UNESCO World Heritage designation	2014;ongoing
		2.2b-2 Develop and Preserve the Nidhe Israel Synagogue and Environs in Bridgetown	Nidhe Israel Synagogue and environs developed into a prime heritage tourism site	2014-2018
		2.2b-3 Enhance the Bay Street Corridor	The Bay Street corridor is enhanced	2014-2018
		2.4-2 Develop an Eco-Centre in the Scotland District	Eco-Centre opened on the East Coast	2018
Modernize Accommodation and Improve the Performance of the Sector	6.1 Improve infrastructure, products and services within the accommodation sector and enhance its overall financial performance	6.1-4 Green the Accommodation Sector	Existing visitor accommodation properties converted to solar powered electricity by 2020 and new developments to utilize this solar technology	2014-2020
Improve Financial performance	5.1 Through a better knowledge/information base, improve the distribution of benefits, investment sourcing and opportunities, business development, and the understanding of the economic impacts, linkages and leakages within the economy, and support local production to reduce import dependency	5.1-6 Improve Cross-Sectoral Linkages	Linkages between the Tourism Sector and a number of other sectors in Barbados is strengthened	2014

Imperative	Strategy	Action	Indicators	Timeframe
Mainstream Environmental Management	11.1 Bring environmental management into the mainstream through improved protected area management and enhanced physical environs, implementation of conservation initiatives, and expanded capacity to provide environmental education and public awareness	11.1-4 Support the Waste Reduction Programme	% reduction in the number of plastic bags ending up in the landfill	2014: ongoing
		11.1-5 Develop a Programme for a Greener Bridgetown	Physical environs and public health standards in Bridgetown improved	2014-17
		11.1-6 Improve the Garrison to Oistins Corridor	Physical environs of the south coast corridor improved	2014-22
Update and Enforce Policy and Legislation to Support the BVE	12.1 Review existing legislation to identify gaps and enforcement measures, and enact new laws to support the functioning of the BVE	12.1-5 Enforce Marine Pollution Legislation	Increase in nature tourists in the near-shore environment	2015;ongoing
Improve the Transportation of People on Land and Near-Shore	8.1 Streamline the movement of people on land and in near-shore waters through enhanced infrastructure, products and services	8.1-3 Extend Directional and Information Signage Programme	Directional and Information Signage Programme extended and signs in place	2014-2018

Source: Government of Barbados, 2014

**Table 35: Enabling Strategic Imperatives promoting Disaster Risk Governance in the Tourism Sector**

Imperative	Strategy	Action	Indicators	Timeframe
11. Mainstream Environmental Management	11.1 Bring environmental management into the mainstream through improved protected area management and enhanced physical environs, implementation of conservation initiatives, and expanded capacity to provide environmental education and public awareness	11.1-2 Implement an Energy Saving Programme in the Tourism Sector	Energy saving programme implemented in the tourism sector	2015
		11.1-3 Develop a Sand Fluidization Programme for Beaches	Number of sand fluidization devices installed	2015;ongoing
12. Update and Enforce Policy and Legislation to support the BVE	12.1 Review existing legislation to identify gaps and enforcement measures, and enact new laws to support the functioning of the BVE	12.1-3 Enact Legislation to Enable Accessible Infrastructure	Legislation pertaining to accessible infrastructure enacted	2017
		12.1-4 Create Environmental Hotline to Support Environmental Regulations	Environmental Hotline launched	End of 2014

Source: Government of Barbados, 2014

**Table 36: Strengthening Disaster Governance within the Health Sector**

Entity	Main Responsibilities	Aims/Objectives	Legislation
<b>The Ministry of Health and Wellness</b>	The government entity responsible for promoting and managing the health of all Barbadians through the provision of comprehensive, coordinated and integrated care, supported by appropriately trained staff, national leadership and standards of excellence. The ministry also seeks to ensure that environmental concerns of the populace are considered in all aspects of national development.	The overarching objectives for the health sector are retained within Goal 3: Building Social Capital of the Barbados National Strategic Plan (2006-2025) and are associated with the following national targets as it relates to CCA and DRM: <ul style="list-style-type: none"> <li>Objective 1.2: Increase in the average life expectancy rate for both males and females.</li> <li>Objective 1.3: Substantially reduce the incidence of communicable and noncommunicable diseases by 2025.</li> <li>Objective 1.6: Achieve a top-ten ranking in the United Nations Human Development Index by 2025</li> </ul>	<ul style="list-style-type: none"> <li>Health Services Act 1969</li> <li>Health Services Regulations</li> </ul>

Source: The National Strategic Plan for Barbados (2006-2025)

**Table 37: Types of Indicators used to promote efficiency and effectiveness and returns on investment in Environmental Health**

Name of Indicator	Scope	Rationale
<b>PAHO's Hospital Safety Index</b> <sup>336</sup>	The probability that a hospital or health facility will continue to function in emergency situations, based on structural, non-structural and functional factors, including the environment and its health services network.	The final HSI score places a health facility into one of three categories (A, B and C) of safety, helping determine where interventions are most urgently needed: <ul style="list-style-type: none"> <li>Category A: deemed able to protect the life of their occupants and likely to continue functioning in disaster situations</li> <li>Category B: can resist a disaster but in which equipment and critical services are at risk</li> <li>Category C: the lives and safety of occupants are deemed at risk during disasters.</li> </ul>
<b>Mortality and burden of disease from unhealthy environments (DALYs/1000 cap)</b>	Total mortality and morbidity rates	This indicator provides an assessment of public health complications arising from unhealthy or unsafe environments. According the Global Health Observatory Data, the fraction of the global burden of disease due to the environment is 22%.
<b>Child Mortality</b>	Total number of children who contracted communicable diseases	This indicator provides an assessment of child mortality in Barbados from communicable versus non-communicable diseases
<b>Maternal and reproductive health</b> <sup>337</sup>	Total number of women who died in child labour	This indicator provides an assessment of maternal mortality in Barbados from communicable versus non-communicable diseases. According the Global Health Observatory Data, there are usually very wide gaps between rich and poor – particularly in urban and rural areas.
<b>Maternal health and the incidence of microcephaly (person/year)</b>	Total number of babies born with microcephaly	This indicator provides an assessment of the incidence of this health complication resulting from exposure to a vector-borne disease as well as requirements for care for such babies in the future.
<b>Hospitalization due to water-borne disease (person/year): Dysentery</b>	Total number of persons who have contracted dysentery	This indicator provides an assessment of the incidence of this water-borne disease, associated deaths & morbidity as well as the extent to which environmental campaigns should be earmarked/revamped towards certain community groups across the island

336 The Queen Elizabeth Hospital, the main health care facility in Barbados, underwent an assessment in 2018. The QEH was rated at Category B on this index. In response to this, the Ministry of Health has since conducted retraining and exploring the possibility of satellite polyclinics.

337 The risk of a woman in a developing country dying from a maternal-related cause during her lifetime is about 33 times higher compared to a woman living in a developed country (GHO, 2019).

Name of Indicator	Scope	Rationale
Hospitalization due to water-borne disease (person/year): E. coli	Total number of persons who have contracted E. coli	This indicator provides an assessment of the incidence of this water-borne disease, associated deaths & morbidity as well as the extent to which environmental campaigns should be earmarked/revamped towards certain community groups across the island
Hospitalization due to water-borne disease (person/year): Gastroenteritis	Total number of persons who have contracted gastroenteritis	This indicator provides an assessment of the incidence of this water-borne disease, associated deaths & morbidity as well as the extent to which environmental campaigns should be earmarked/revamped towards certain community groups across the island
Water and sanitation	Total mortality and morbidity rates	This indicator provides an assessment of public health complications arising from overall water quality issues (prior and after the occurrence of natural hazards)
Hospitalization due to thermal extremes: Heat Strokes (person/year)	Total number of persons who have had heat strokes	This indicator provides an assessment of daily mortality, hospital admissions and clinic/emergency room attendance
Hospitalization due to complex extremes	Total number of persons hospitalized during/following extreme weather events (floods, tropical storms, tropical cyclones, droughts)	This indicator provides an assessment of attributed deaths, hospital admissions, infectious disease surveillance data; mental health; and nutritional status
Hospitalization due to food-borne disease (person/year): Salmonella	Total number of persons who contracted salmonella	This indicator provides an assessment of the incidence of this food-borne/water-borne disease, associated deaths & morbidity as well as the extent to which environmental campaigns should be earmarked/revamped towards certain community groups across the island
Hospitalization due to food-borne disease (person/year): Leptospirosis	Total number of persons who contracted leptospirosis	This indicator provides an assessment of the incidence and location of vector populations, associated deaths & morbidity as well as the extent to which environmental campaigns should be earmarked/revamped across temporal and geographical distributions
Hospitalization due to vector-borne diseases: dengue fever (person/year)	Total number of persons who have contracted dengue fever	This indicator provides an assessment of the incidence of this vector-borne disease as well as the extent to which environmental campaigns should be earmarked/revamped towards certain community groups across the island
Hospitalization due to vector-borne diseases: zika virus (person/year)	Total number of persons who have contracted zika virus	This indicator provides an assessment of the incidence of this vector-borne disease as well as the extent to which environmental campaigns should be earmarked/revamped towards certain community groups across the island
Hospitalization due to vector-borne diseases: chikungunya (person/year)	Total number of persons who have contracted chikungunya	This indicator provides an assessment of the incidence of this vector-borne disease as well as the extent to which environmental campaigns should be earmarked/revamped towards certain community groups across the island.
Cause of death: Non-Communicable Diseases (person/year)	Total number of persons who died from communicable diseases	This indicator provides an estimate of the number of persons who died from communicable versus relative to the incidence of non-communicable diseases
Cause of death: Communicable Diseases (person/year)	Total number of persons who died from communicable diseases from thermal extremes, water-borne, food-borne or vector-borne illnesses	This indicator provides an estimate of the number of persons who died from communicable versus relative to the incidence of non-communicable diseases

Source: Author' Adaptation; Global Health Observatory Data (2019)

# APPENDIX XI: Thematic Recommendations for Roadmap Outcomes under the Barbados MHEWS Roadmap and Action Plan (2021- 2024)

**Table 38: Thematic Recommendations for Roadmap Outcome 1**

ROADMAP OUTCOME AREA 1 Enhanced institutional framework for MHEWS in Barbados				
PILLAR 4: PREPAREDNESS AND RESPONSE CAPABILITIES				
Description of the Pillar: The institutions and people, particularly people in vulnerable conditions, who are better able to respond to a warning through enhanced education on hazard risk (Source: CDEMA Multi-Hazard Early Warning Systems: A Checklist, p.44).				
CDM CWP 2019-2023 Alignment	EWS Pillar	Gaps Identified	Thematic Recommendations	Intended Result
<p><b>Priority Area 1:</b> Institutional Strengthening for CDM</p> <p><i>Outcome Area 1.1:</i> Strengthen enabling environment for CDM</p> <p><i>Output 1.1.1:</i> CDM integrated into National policy and legislation</p>	<p><b>Preparedness and Response Capabilities</b></p>	<ul style="list-style-type: none"> <li>Limited legislative, policy and Planning framework for the development and delivery services at national, sectoral and regional levels.</li> <li>Limited sustainability planning; and</li> <li>Lack of monitoring, evaluation and reporting (MER) frameworks for measuring progress on climate services development.</li> </ul>	<p><b>Thematic Recommendation 1:</b> Enhanced EWS Policy</p>	<p>A MHEWS Policy informed by CDM principles and processes for the design, operation, management, monitoring, and evaluation of EWS in Barbados is developed and implemented.</p>

Source: The Multi-Hazard Early Warning Systems Roadmap and Action Plan: Barbados (2021-2024)

**Table 39: Thematic Recommendations for Roadmap Outcome 2**

ROADMAP OUTCOME AREA 2 Enhanced mechanisms for the collection, management and dissemination of MHEWS scientific data				
PILLAR 3: WARNING DISSEMINATION AND COMMUNICATION				
Description of the Pillar: Systems which ensure people and communities, particularly those in vulnerable conditions, are warned in advance of impending hazard events, facilitating national and regional coordination and information exchange (Source: CDEMA Multi-Hazard Early Warning Systems: A Checklist, p.40).				
CDM CWP 2019-2023 Alignment	EWS Pillar	Gaps Identified	Thematic Recommendations	Intended Result
<p><b>Priority Area 2:</b> Preparedness Response and Mitigation Capacity</p> <p><i>Outcome Area 2.1:</i> Operational readiness enhanced</p> <p><i>Output 2.1.3</i> Communications and EWS improved</p>	<p><b>Warning Dissemination and Communication</b></p>	<ul style="list-style-type: none"> <li>Disconnect in information platforms across hazards and timescales.</li> <li>Limited stakeholder engagement at regional and national levels.</li> <li>Limited dissemination channels (use of existing channels and diversity across existing channels especially at the national level).</li> </ul>	<p><b>Thematic Recommendation 3:</b> Improvements in Public Education and Communication</p>	<p>Improved public awareness and understanding of the MHEWS among communities to enhance readiness and response capabilities to reduce disaster risk.</p>

Source: The Multi-Hazard Early Warning Systems Roadmap and Action Plan: Barbados (2021-2024)

**Table 40: Thematic Recommendations for Roadmap Outcome 3**

ROADMAP OUTCOME AREA 3				
Improved and harmonised information systems to support decision making at all levels				
PILLAR 1: DISASTER RISK KNOWLEDGE				
Description of the Pillar: Disaster risk knowledge is comprehensive information on all dimensions of disaster risk, including hazards, exposure vulnerability and capacity related to persons, communities', organizations and countries and their assets (Source: CDEMA Multi-Hazard Early Warning Systems: A Checklist, p.30).				
CDM CWP 2019-2023 Alignment	EWS Pillar	Gaps Identified	Thematic Recommendations	Intended Result
<p><b>Priority Area 3:</b> Strengthening Community Resilience</p> <p><i>Outcome Area 3.1:</i> Strengthened community mitigation, preparedness and response</p> <p><i>Output 3.1.1</i> Community-based EWS established in vulnerable communities</p>	<b>Disaster Risk Knowledge</b>	<ul style="list-style-type: none"> <li>• Need to expand, integrate and maintain hazard monitoring systems to meet current and changing needs</li> <li>• Limited data sharing and exchange across the MHEWS community needs.</li> <li>• Limited quality controlled, historical/ real-time sectoral data at appropriate spatial and temporal scales.</li> </ul>	<b>Thematic Recommendation 2:</b> Improved Management Systems for Data Capture and Use	Improved MHEWS data management platform that employs a balance of scientific and technological approaches with indigenous knowledge to capture data and disseminate accurate warnings.

Source: The Multi-Hazard Early Warning Systems Roadmap and Action Plan: Barbados (2021-2024)

**Table 41: Thematic Recommendations for Roadmap Outcome 4**

ROADMAP OUTCOME AREA 4				
Strengthened capacity development and enabling environment for MHEWS				
PILLAR 2: DETECTION, MONITORING, ANALYSIS FORECASTING FOR HAZARDS AND POSSIBLE CONSEQUENCES				
Description of the Pillar: Related to multi-hazard monitoring and forecasting services with sound scientific and technological basis (Source: CDEMA Multi-Hazard Early Warning Systems: A Checklist, p.35).				
CDM CWP 2019-2023 Alignment	EWS Pillar	Gaps Identified	Thematic Recommendations	Intended Result
<p><b>Priority Area 2:</b> Preparedness Response and Mitigation Capacity</p> <p><i>Outcome Area 2.1:</i> Operational readiness enhanced</p> <p><i>Output 2.1.2</i> Training and exercising programme strengthened</p>	<b>Warning Dissemination and Communication</b>	<ul style="list-style-type: none"> <li>• Limited functionality and integration of decision-support platforms and tools to support sector-specific and cross-sectoral impacts-based forecasting.</li> <li>• Technical complexity(e.g. language, graphics) and limited tailoring of information to user needs.</li> <li>• Limited user and provider capacity for EWS service use and development.</li> <li>• Lack of sector-specific and cross-sectoral research on impacts-based forecasting.</li> </ul>	<b>Thematic Recommendation 4:</b> Capacity Development	The MHEWS is supported by defined competency standards for EWS professionals and volunteers and a comprehensive capacity development programme.

Source: The Multi-Hazard Early Warning Systems Roadmap and Action Plan: Barbados (2021-2024)

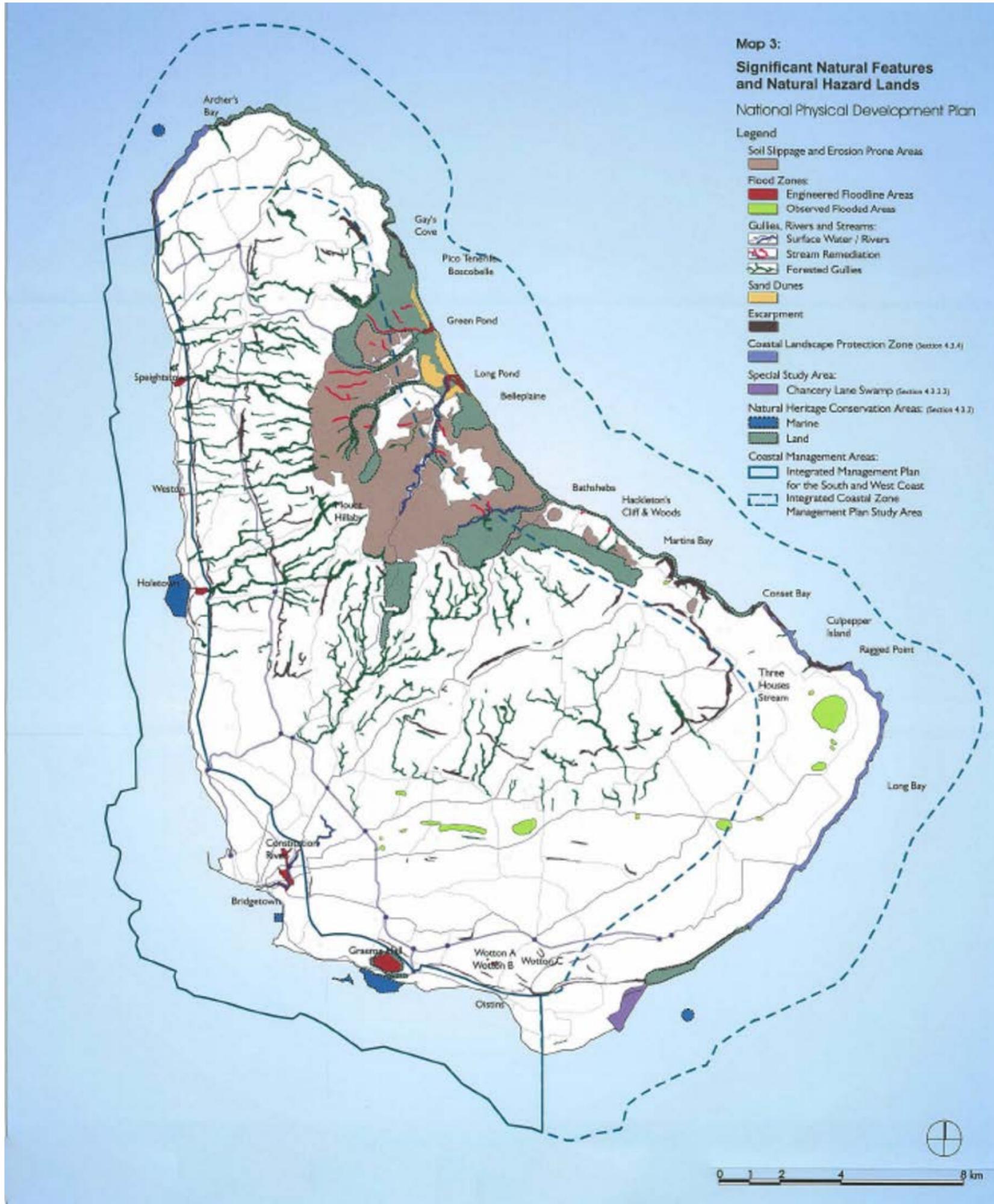
**Table 42: Thematic Recommendations for Roadmap Outcome 5**

ROADMAP OUTCOME AREA 5 Strengthened mechanism for MHEWS resourcing				
ALL PILLARS				
Description of the Pillar: The issue of human, financial and technical resourcing is integral to any proposed enhancement of the MHEWS programme.				
CDM CWP 2019-2023 Alignment	EWS Pillar	Gaps Identified	Thematic Recommendations	Intended Result
<p><b>Priority Area 3:</b> Strengthening Community Resilience</p> <p><i>Outcome Area 3.1:</i> Strengthened community mitigation, preparedness and response</p> <p><i>Output 3.1.1</i> Community-based EWS established in vulnerable communities</p>	ALL PILLARS	<ul style="list-style-type: none"> <li>Limited hazard, environmental and social science research to inform the production of tailored, sector-specific information on regional, national and community scales</li> <li>Lack of interdisciplinary demand-driven early warning services research and innovation.</li> </ul>	<p><b>Thematic Recommendation 5:</b> MHEWS Resourcing</p>	Adequate human and financial resources at the national and local levels allocated to support a MHEWS underpinned by evidence-based reporting and capacity development.

Source: The Multi-Hazard Early Warning Systems Roadmap and Action Plan: Barbados (2021-2024)



Figure 91: Significant Natural Features and Natural Hazard Lands



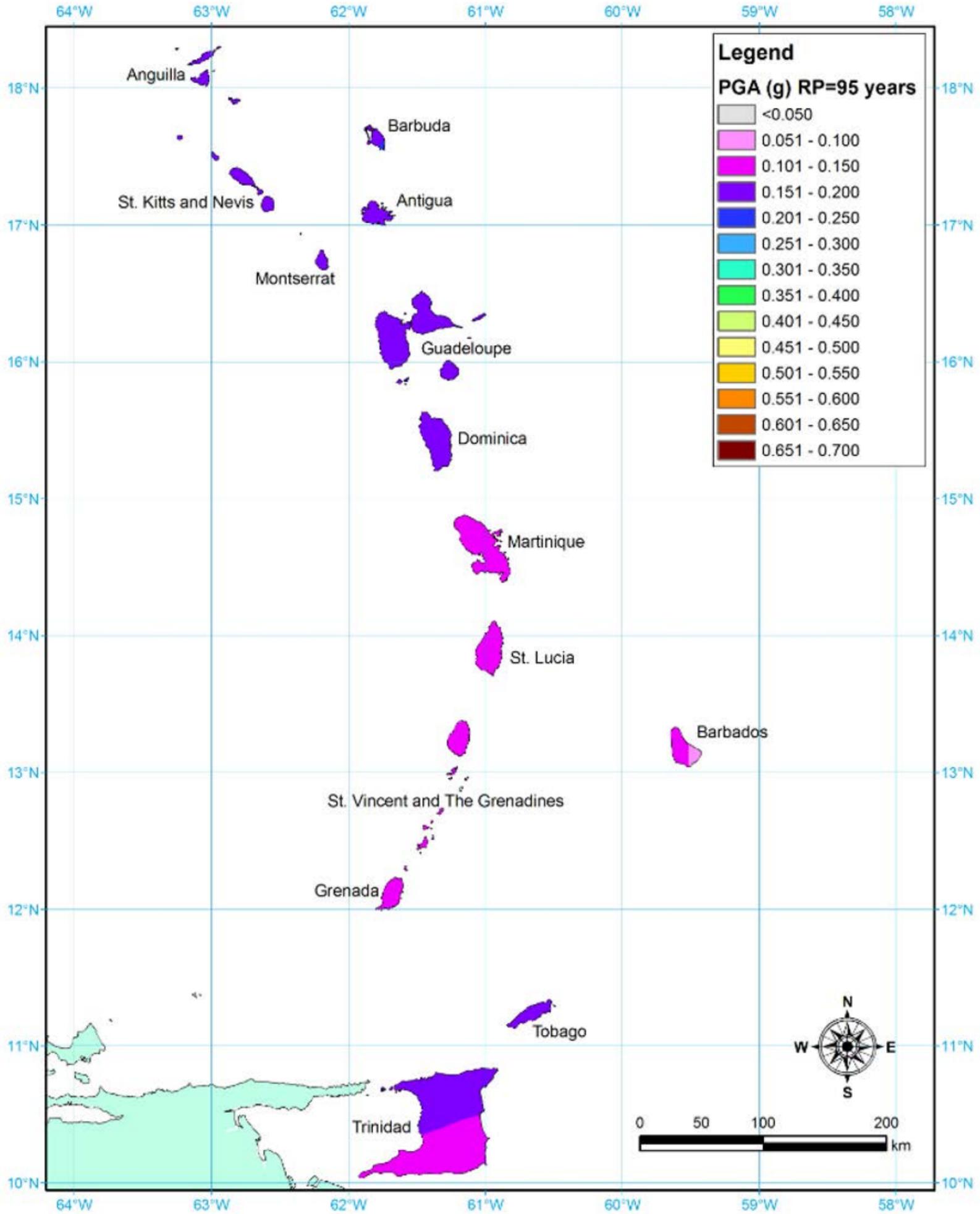
Source: The Barbados Physical Development Plan (amended 2003)

Figure 92: Coastal Zone Management Sub-Areas



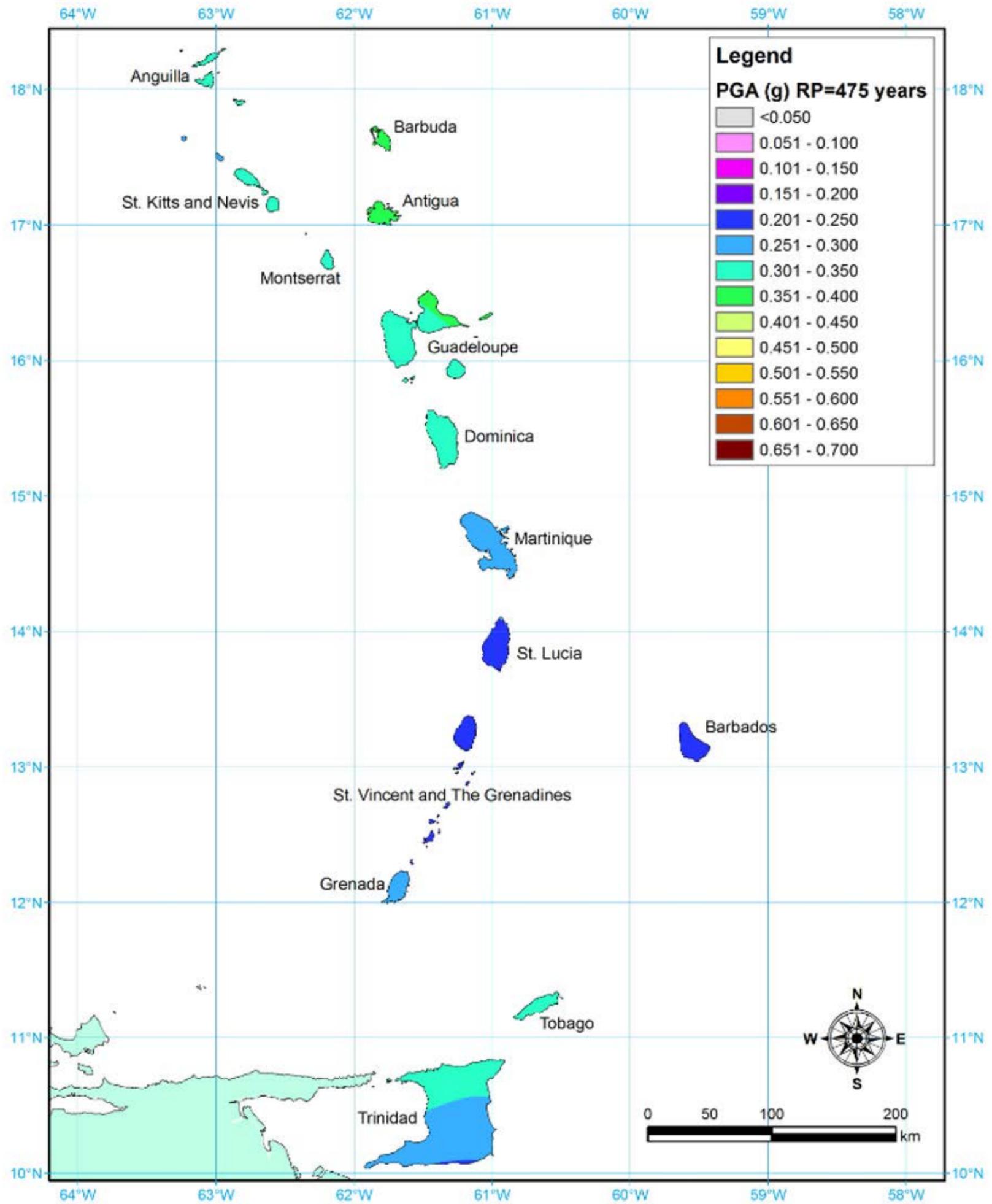
Source: The Coastal Zone Management Unit

**Figure 93: Seismic regional hazard maps for the Eastern Caribbean**  
**Figure 93A: Seismic regional hazard maps for the Eastern Caribbean showing peak ground acceleration (PGA) for return periods (RP) of 95 years**



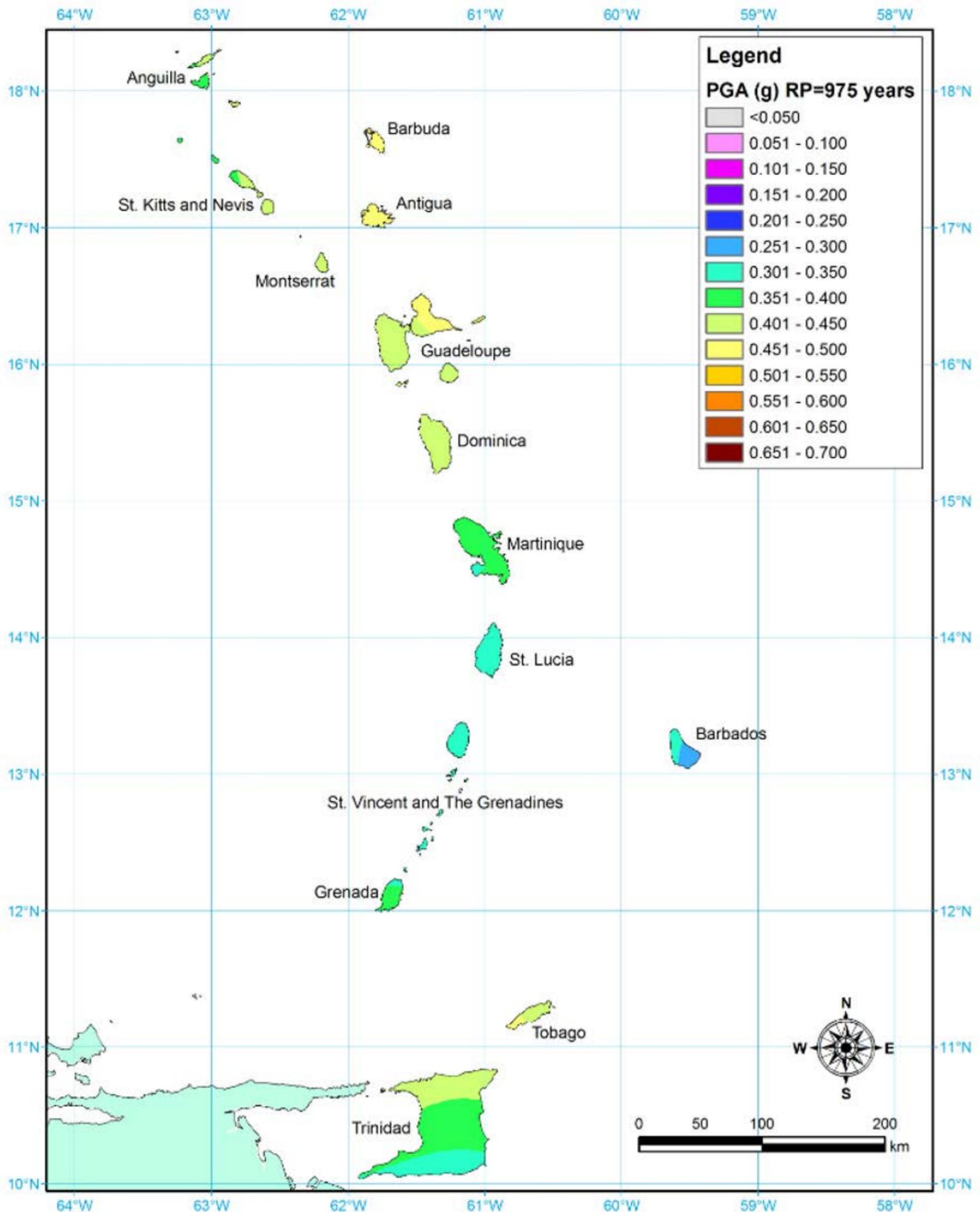
Source: The University of the West Indies: Seismic Research Centre. 2022

Figure 93B: Seismic regional hazard maps for the Eastern Caribbean showing peak ground acceleration (PGA) for return periods (RP) of 475 years



Source: The University of the West Indies: Seismic Research Centre. 2022

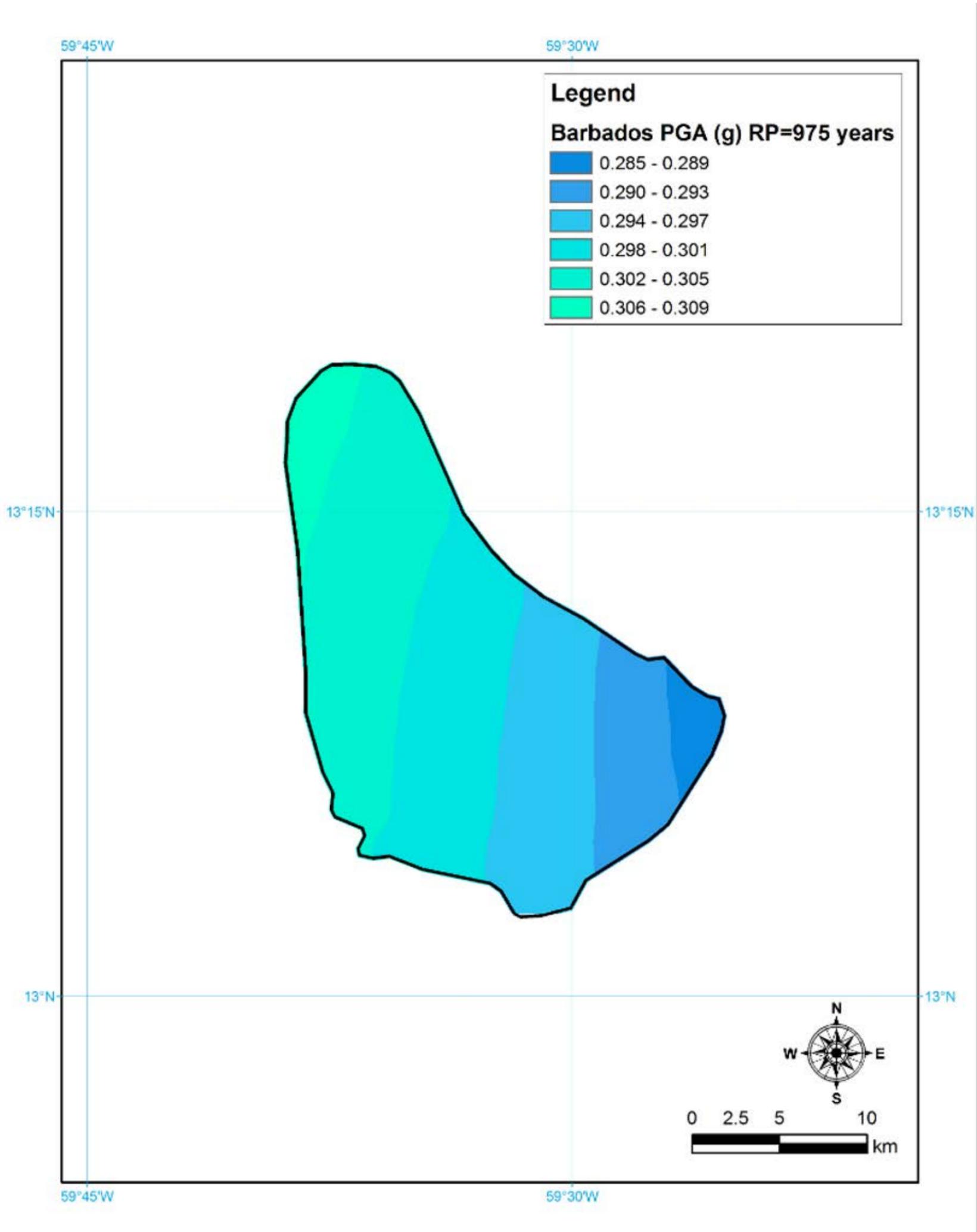
**Figure 93C: Seismic regional hazard maps for the Eastern Caribbean showing peak ground acceleration (PGA) for return periods (RP) of 975 years**



Source: The University of the West Indies: Seismic Research Centre. 2022

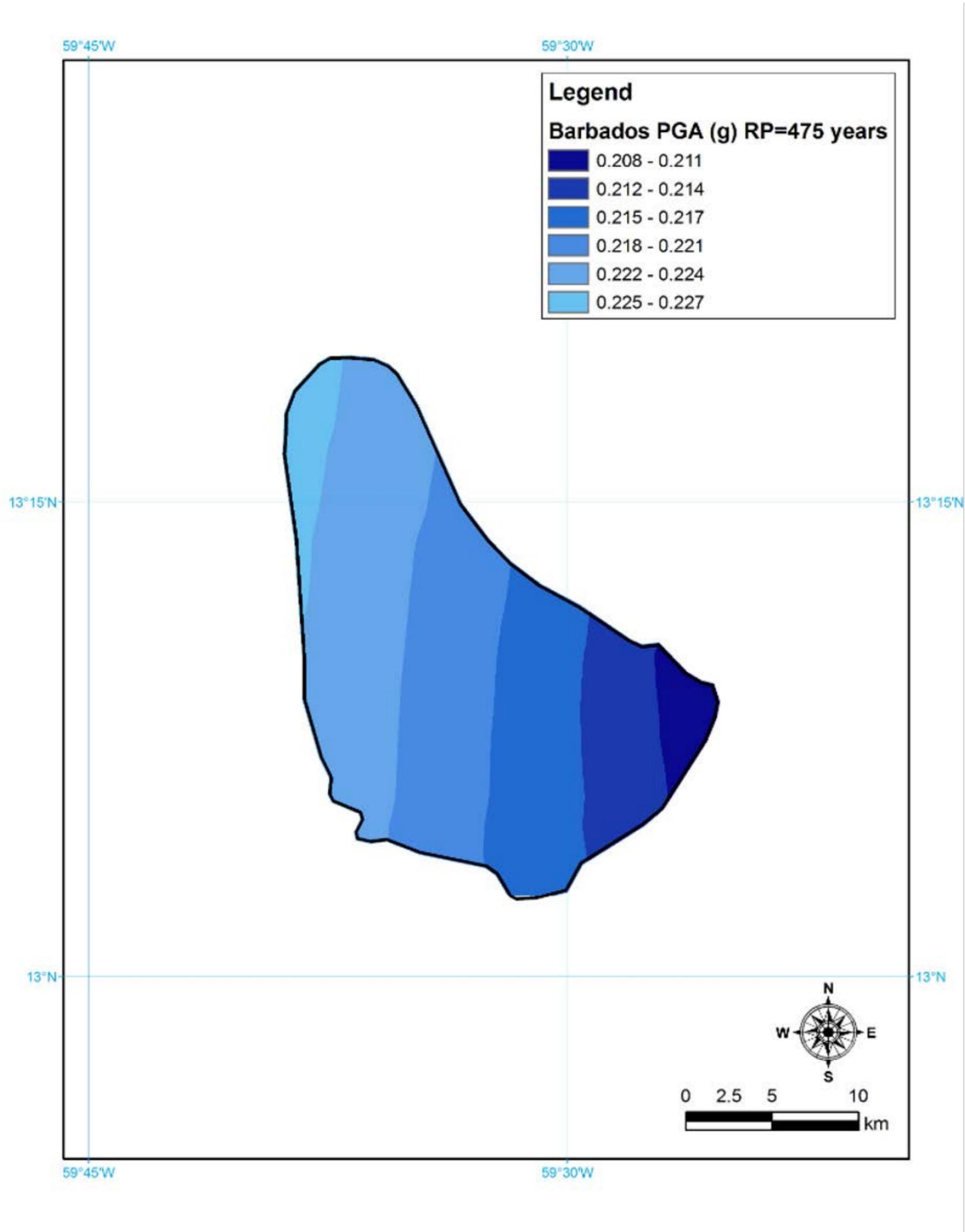
Figure 94: Seismic national hazard maps for Barbados

Figure 94A: Seismic national hazard maps for Barbados showing peak ground acceleration (PGA) for return periods (RP) of 95 years



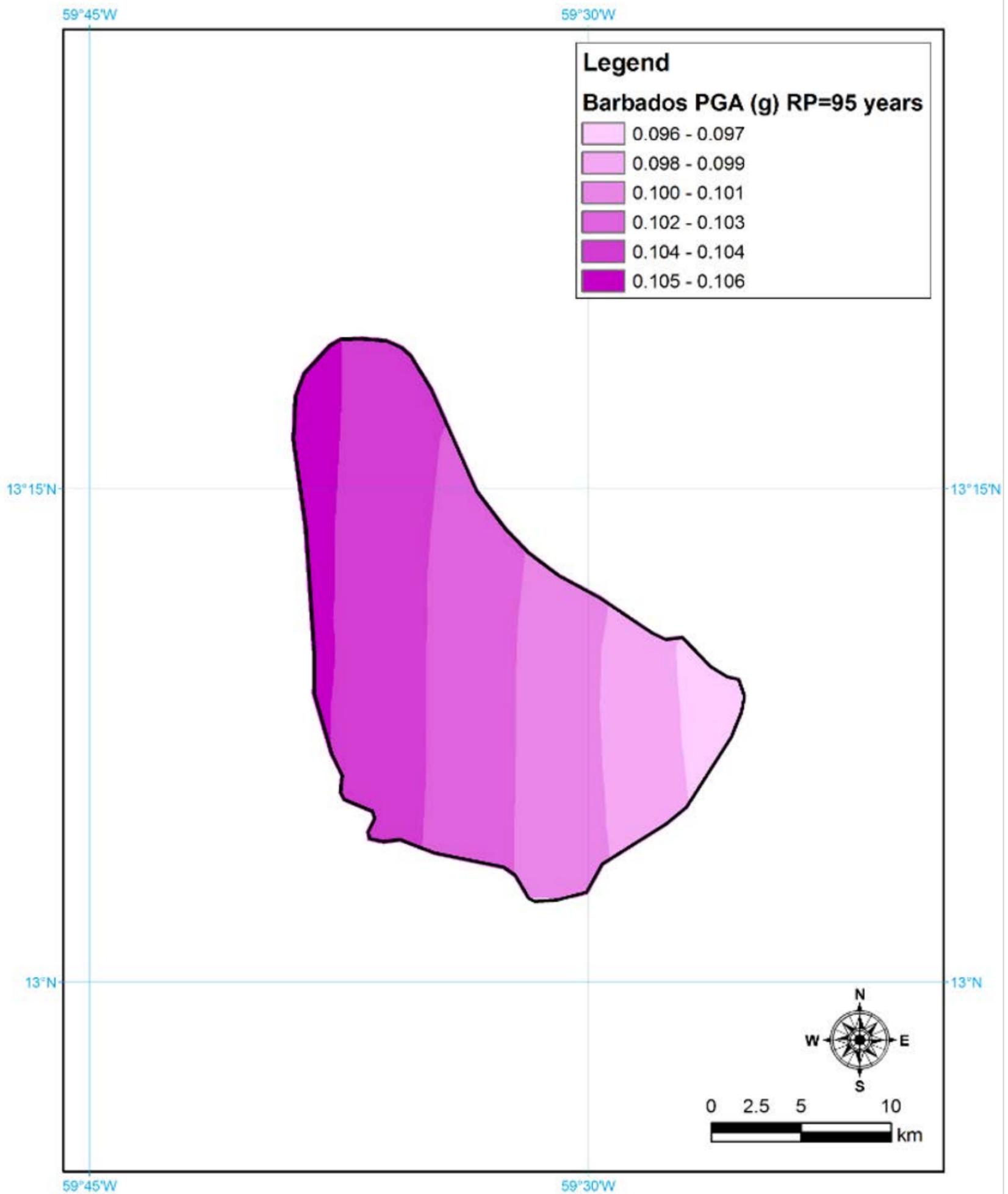
Source: The University of the West Indies: Seismic Research Centre. 2022

Figure 94B: Seismic national hazard maps for Barbados showing peak ground acceleration (PGA) for return periods (RP) of 475 years



Source: The University of the West Indies: Seismic Research Centre. 2022

Figure 94C: Seismic national hazard maps for Barbados showing peak ground acceleration (PGA) for return periods (RP) of 975 years



Source: The University of the West Indies: Seismic Research Centre. 2022

# APPENDIX XIII:

## Hurricane Impacts since colonization

### Box 10: Hurricane Impacts since colonisation

- 1660, December: Hurricane. Vessels ran aground.
- 1674, August 10: Very strong hurricane. 300 buildings destroyed; 200 dead; no sugarcane for two years.
- 1675, August 31: Strong hurricane. Island devastated
- 1694, October 17: Weak hurricane passes. Ships thrown ashore.
- 1780, October 10: Slow moving hurricane. Barbados battered for 48 hours. 4 326 dead; £1 million damage.
- 1786, September: Severe gale. Every vessel driven ashore. Great damage to homes and crops. Many people killed.
- 1813, July 22: Tropical storm passed north. Ships damaged.
- 1815, September 29: Hurricane passed north of island. Gale force winds experienced.
- 1816, September 15: Hurricane passed north. Heavy rains; severe flooding; stores damaged.
- 1817, October 21: Passing hurricane damaged ships;
- 1819, October 13: Hurricane. Two dead; heavy rains; Foster Hall landslides; ships wrecked; 1822, December 19: Hurricane passed north; winds from south and west; very heavy seas.
- 1831, August 10: Severe hurricane. Over £2 million damage; 1 525 dead. 1837, July 9: Tropical storm hit island. Vessels thrown ashore; one church destroyed; chimneys blown down.
- 1846, September 11: Severe tropical storm passed south and drove vessels ashore.
- 1848, September 18: Tropical storm passed north dumping much rain.
- 1855, August 24: Tropical storm killed three; drove boats ashore. Rainfall was 9 inches at Edgecumbe and 10.36 inches at Bayfield.
- 1872, September 8: Severe thunderstorm. Between 8.01 and 11.02 inches of rain.
- 1877, September 21: Tropical storm passed over Barbados. No serious damage.
- 1886, August 15: Hurricane passed 40 miles north of Barbados. Gale force winds; 7-9 inches of rain; floods in St. Michael; landslides in St. Joseph and St. Thomas
- 1894, October 12: Tropical storm passed north-west. Destroyed hundreds of homes; 18 fishermen missing.
- 1898, September 10: Strong hurricane passed south. 83 dead; 9 937 houses destroyed, 4 519 damaged; 50 000 homeless.
- 1901, July 2: Tropical storm passed south. Severe floods, more than 20 inches of rain in St. Peter killing one person.
- 1949, August 31: Weak tropical storm dumped over 10 inches of rain in St. Joseph, St. John, St. Thomas, St. George; 5 to 6 inches of rain in the north.
- 1955: September 22: Hurricane Janet passed south of Barbados. Winds over 110 mph damaged or destroyed 8 100 small houses, 20 000 homeless.
- 1963, September 24: Hurricane Edith passed 50 miles south; 7 to 8 inches rain.
- 1970, October 1: Tropical depression. Flooding in Bridgetown and St. Michael.
- 1980, August 3: Hurricane Allen passed north of Barbados. Destroyed about 35 houses and damaged 200 more

Source: The Barbados Meteorological Services; The Barbados Museum and Historical Society

## APPENDIX XIV: Volcanic Hazards in the Eastern Caribbean (Last 300 years)

Table 43: Volcanic Hazards in the Eastern Caribbean over the Last 300 years

YEAR	VOLCANO	NATURE OF DISASTER (COSTS IN YEAR 2000 DOLLARS) *
1718	La Soufrière (St. Vincent)	Major explosive eruption. Unknown number of casualties amongst indigenous Caribs.
1812	La Soufrière (St. Vincent)	Major explosive eruption. About 80 deaths. Considerable damage to the sugar industry. Economic cost unknown.
1902	La Soufrière (St. Vincent)	Major explosive eruption. About 1,600 deaths. Considerable damage to the sugar industry. Economic cost estimated at US\$200,000,000.
1902	Mt Pelé (Martinique)	Major explosive/effusive eruption. Over 30,000 deaths. Complete destruction of the city of St. Pierre. Other damage to agriculture considerable. Economic cost about US\$1,000,000,000.
1976 – 1977	Soufrière (Guadeloupe)	Minor phreatic (steam) eruption. No casualties but economic cost estimated at US\$1,000,000,000
1979	La Soufrière (St. Vincent)	Moderate explosive eruption. No casualties but economic losses to the order of US\$100,000,000
1995 – present	Soufrière Hills (Montserrat)	Moderate explosive/effusive eruption. About 20 deaths. Complete destruction of capital, Plymouth. Economic cost not yet estimated but in excess of US\$500,000,000. Complete destruction of the economy.
2021	La Soufrière (St. Vincent)	Major explosive/effusive eruption. Damage to areas in the north of the island. No deaths. ~18,000 persons evacuated

Source: The University of the West Indies: Seismic Research Centre



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