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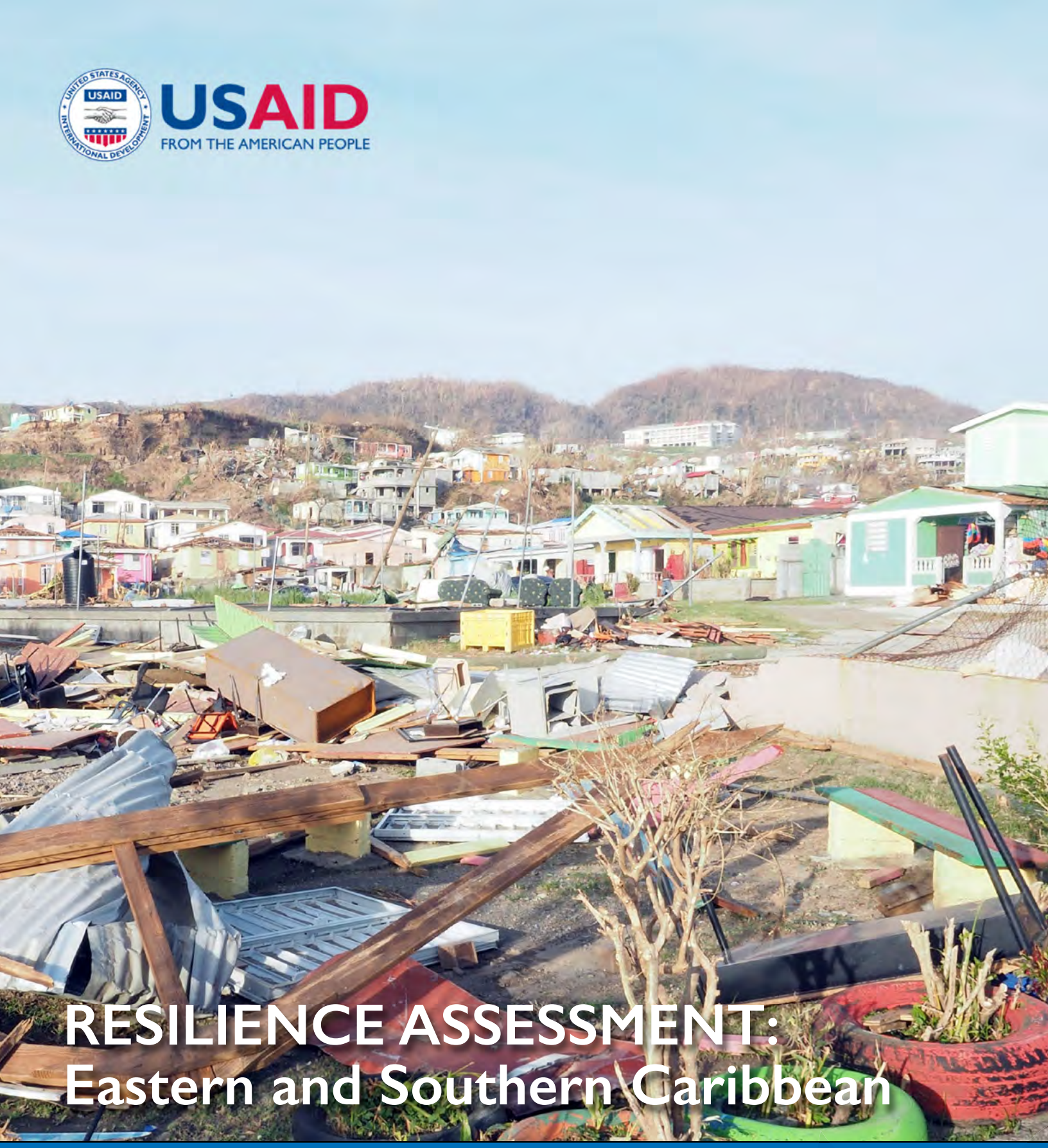

RESILIENCE ASSESSMENT: Eastern and Southern Caribbean

December 2020

This document was produced for review by the United States Agency for International Development. It was prepared by Environmental Incentives and ICF for the LAC Environment Support Contract.

CONTRACT INFORMATION

This program is made possible by the generous support of the American people through the United States Agency for International Development (USAID) under the terms of its requisition number REQ-LAC-19-000022 (Latin America and the Caribbean Environment Support Contract (LAC ESSC) implemented by prime recipient Environmental Incentives, LLC (EI) with partner ICF Macro, Inc. LAC ESSC has been issued under contract number GS-00F-193DA and supports the same program objectives as described in RFQ number 7200AA19M00008. LAC ESSC is funded and managed by the USAID Bureau for Latin America and the Caribbean, Office of Regional Sustainable Development and Environmental activities.

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ACKNOWLEDGEMENTS

We are grateful for the careful guidance of Nikki Hassell and Mansfield Blackwood of the United States Agency for International Development's (USAID's) Eastern and Southern Caribbean Regional Mission. Thanks also to their Mission colleagues whose feedback on early outlines and drafts of this assessment identified key issues to include. We humbly thank the more than sixty regional stakeholders who provided valuable insights without which this assessment would not have been possible. We are inspired by the dedication with which you work to improve your communities, your countries, your region, and yes, the world.

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COVER PHOTO

Hurricane Maria devastated parts of the Eastern Southern Caribbean, including Dominica shown here, in September 2017. The Category 5 hurricane was deadliest Atlantic hurricane since Mitch in 1998

BACK COVER PHOTO

Suriname beach. Photo by Vincent van Zalinge on Unsplash

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Photo Courtesy: National Oceanic and Atmospheric Administration

ACRONYMS AND ABBREVIATIONS

AOSIS	Alliance of Small Island States
CARDI	Caribbean Agricultural Research and Development Institute
CARICOM	Caribbean Community
CCCCC	Caribbean Community Climate Change Centre
CCRIF SPC	Caribbean Catastrophe Risk Insurance Facility Segregated Portfolio Company
CDB	Caribbean Development Bank
CDC	Civil Defense Commission
CDEMA	Caribbean Disaster Emergency Management Agency
CIMH	Caribbean Institute for Meteorology and Hydrology
CORE	Communities Organized and Ready for Emergencies
CSO	Civil Society Organization
DFID	Department for International Development
ECDPG	Eastern Caribbean Development Partners Group
ECLAC	Economic Commission for Latin America and the Caribbean
ESC	Eastern and Southern Caribbean
FAO	Food and Agriculture Organization
GCF	Green Climate Fund
GDP	Gross Domestic Product
GFDRR	Global Facility for Disaster Reduction and Recovery
GIZ	German Agency for International Cooperation
GRENCODA	Grenada Community Development Agency
ICZM	Integrated Coastal Zone Management
IDB	Inter-American Development Bank
IISD	International Institute for Sustainable Development
IMF	International Monetary Fund
INDC	Intended Nationally Determined Contribution
IPCC	Intergovernmental Panel on Climate Change
IUCN	International Union for Conservation of Nature
LAC	Latin America and the Caribbean
MHEWS	Multi-Hazard Early Warning System
NaDMA	National Disaster Management Agency
NCRIPP	National Coastal Risk Information and Planning Platform
NDC	Nationally Determined Contribution
NEMO	National Emergency Management Organization
NGO	Non-governmental Organization
NODS	National Office for Disaster Services
ODPM	Office of Disaster Preparedness and Management
OECS	Organization of Eastern Caribbean States
PAHO	Pan American Health Organization
RCP	Representative Concentration Pathway

RRM	Regional Response Mechanism
R2RP	Roofs to Reef Program
SIDS	Small Island Developing States
UN	United Nations
UNFCCC	United Nations Framework Convention on Climate Change
UNDP	United Nations Development Programme
UNDRR	United Nations Office for Disaster Risk Reduction
UNICEF	United Nations Children's Emergency Fund
USAID	United States Agency for International Development
UWI	University of the West Indies
WMO	World Meteorological Organization
WTO	World Trade Organization

Photo Credit: Julian Wyss for USAID
Dominica after Hurricane Maria.

EXECUTIVE SUMMARY

The Eastern and Southern Caribbean (ESC) region is highly vulnerable to natural hazards. In recent years, the region has endured extreme hurricanes that devastated communities and infrastructure and left thousands of people without shelter, livelihoods, and services. Countries in the ESC region are also prone to droughts, earthquakes and volcanoes, tsunamis, extreme heat and precipitation, and storm surges. The economic impact is staggering–Caribbean countries incurred an estimated $27 billion in losses and damages from natural hazards between 2000 and 2017 (Friar 2019). With climate change, risks to the region from natural hazards are expected to mount as sea level rises, precipitation patterns change, and temperature increases.

Resilience is a key imperative for Caribbean countries. The United States Agency for International Development Eastern and Southern Caribbean Mission (USAID/ESC) partners with regional and national institutions to support long-term resilience to natural hazards and advance their Journeys to Self-Reliance. This resilience assessment is designed to inform USAID/ESC in the development and implementation of its new Regional Development Cooperation Strategy. A significant component of the strategy will focus on building the resilience of the countries in the region. The identified gaps and recommendations are intended to ensure USAID investments focus on the most significant needs of ESC countries, align with regional strategies, and target support that increases the region's absorptive, adaptive, and transformative resilience capacities.

Components of Resilience Capacity adapted from the USAID Climate Risk Management Framework.

Assessing resilience requires an understanding of the socioeconomic, environmental, and institutional context; the natural hazards and human-induced stressors and their impacts on communities and key development sectors; and the existing resilience capacities and measures, as shown in the diagram here. To understand these factors, the study team conducted a desk review of 166 key studies and strategic documents[1] and consulted 65 regional and national stakeholders, USAID personnel, and international donors across the ESC region while focusing on six countries: Antigua and Barbuda, Saint Lucia, Grenada, Barbados, Trinidad and Tobago, and Guyana. With these inputs, the team developed a nuanced understanding of current and future risks, how decision makers are working to build resilience, key gaps, and distinctions between national and regional capacities and needs.

1 Among these were Building a Caribbean Pathway for Disaster Resilience in the Caribbean Community (CARICOM, 2019); CDEMA's Regional Comprehensive Disaster Management Strategy and Programming Framework (2014–2024); and CCCCC's Climate Change and the Caribbean: A Regional Strategy for Achieving Development Resilient to Climate Change (2009–2015–currently being updated for 2020–2030).

KEY FINDINGS

The countries of the ESC region vary tremendously in size, geography, economy, and culture and in the likelihood and severity of risks they face from different hazards—from hurricanes and droughts to volcanoes and earthquakes. Vast differences also exist in the capacity of their national institutions and communities to prepare for and recover from hazards. The assessment found USAID/ESC could invest in strengthening the region's resilience ecosystem most effectively by taking systems- and sector-level approaches, focusing on core capabilities and sustainable programming, supporting and strengthening coordination at all levels, and balancing regional and country-specific programming. In particular, the assessment found while individual countries varied in their resilience capabilities, there are seven key gaps that provide opportunities for USAID/ESC to strengthen regional resilience. Five of these key gaps relate to strengthening the integration of resilience across systems and sectors, and two gaps relate to strengthening citizen and community resilience. Addressing both of these types of gaps is needed to support the ESC region's Journey to Self-Reliance.

STRENGTHEN INTEGRATION OF RESILIENCE ACROSS SYSTEMS AND SECTORS

GAP AND RECOMMENDATION 1

Gap: While ESC countries face risks from multiple hazards, there are few systems in place to align information about response and recovery from these hazards, or to develop integrated strategies to build mutually reinforcing resilience. These findings signal a real need for a coordinated multi-hazard approach.

Recommendation: Promote and support a multi-hazard approach. Support the development and implementation of an integrated multi-hazard approach to disaster risk management and climate change adaptation across the region and in countries that maximizes effectiveness and efficiency by:

- Supporting the co-design process of an integrated multi-hazard approach that engages a broad range of partners and stakeholders to enhance stakeholder collaboration, buy-in, and interaction in the region.
- Developing technical capacity to address systemic weaknesses in absorptive, adaptive, and transformative resilience capacities.
- Supporting national-level implementation of components of a multi-hazard approach, including policy development, institutional coordination, early warning system improvement, and financing aligned with implementation.

GAP AND RECOMMENDATION 2

Gap: The interdependency of economic sectors (e.g., tourism, transportation) and services (e.g., power and water supply) increases their risk of severe impacts from natural hazards and climate change. Yet, disaster risk reduction and climate change adaptation remain siloed across sectors and services, and weak collaboration and coordination among government offices undermine effective planning and response.

Recommendation: Build national capacity for sector and inter-ministerial integration. Promote coordination and information sharing between disaster risk management and sector agencies and support technical and institutional development to strengthen national capacity to address multiple hazards and climate change by:

- Encouraging national governments to elevate risk management to a ministerial or departmental level, signaling an increase in political will and standing, enhancing the coordination of sectoral investments to address multiple hazards, and addressing resource challenges.

- Promoting an integrated approach to national resilience, including aligning disaster risk management and climate change adaptation.
- Supporting the development of legislation to promote a sustainable blue (marine and coastal based) economy to increase resilience in coastal areas.
- Supporting countries' core sectors, such as energy, agriculture, tourism, water, biodiversity conservation, and natural resource management, in building technical capacity and knowledge about disaster risk reduction and climate change adaptation.
- Supporting the transition to digital and virtual platforms, as spurred by the realities of COVID-19, that could expand the reach and accessibility of virtual training programs and platforms.

GAP AND RECOMMENDATION 3

Gap: ESC island countries are highly dependent–economically and for resources–on other countries. The COVID-19 pandemic lockdown highlighted the precariousness of mono-sector economies dependent on tourism, and the fragility of their food, energy, and water security. These critical sectors are also highly sensitive to natural hazard impacts.

Recommendation: Build sustainable and equitable economic independence to increase resilience and self-reliance. Support integration of resilience to natural hazards and climate change into emerging national priorities for energy, food and water security, and greenhouse gas emission reductions by:

- Integrating resilience to natural hazards into USAID's planned Caribbean Energy Initiative and other U.S. Government investments in renewables that support low emissions development pathways.
- Building on agricultural innovations to increase food security and strengthen agricultural-based livelihoods while increasing the agriculture sector's resilience to natural hazards and climate change.
- Supporting blue economy efforts to reignite economic growth, reduce unemployment, improve food security, and reduce overall poverty while building resilience to natural hazards and climate change.
- Supporting water security and resilience through targeted training, promoting water savings and conservation, and taking account of natural hazard risk in water supply and sanitation investments.

GAP AND RECOMMENDATION 4

Gap: Financial losses caused by natural hazards continue to rise; ESC countries face significant financial risk and major budget volatility due to natural hazards. Indebted ESC countries struggle to move beyond disaster response towards mitigation and broader resilience. Small- and medium-sized enterprises are often more vulnerable to natural hazards and face more severe impacts during disaster events than large businesses.

Recommendation: Build financial capacity and financial products that support and sustain integrated resilience. Invest in financial management capacity that builds both national government and private sector actors' capacity to absorb, adapt to, and mitigate impacts from multiple and cascading natural hazards by:

- Improving the capacity of disaster risk managers, sector planners, and ministries of finance and planning to understand and access risk management financing, develop national budget reserves, and incorporate disaster risk financing in national planning.

- Supporting efforts to align existing regional and national disaster risk and adaptation financing and investments to support multi-hazard relief, response, and reconstruction.
- Supporting national capacity for alternative financing mechanisms to support all areas of disaster and climate change resilience.
- Assessing blended finance products that catalyze high-impact private sector investments and advisory projects where actual or perceived risks are too high for commercial finance alone.
- Further improving small- and medium-sized enterprises' access to climate adaptation finance to strengthen value chain resilience, local livelihoods, and national economies.

GAP AND RECOMMENDATION 5

Gap: A key driver of comprehensive disaster risk management is a risk-informed legal framework. Existing disaster-based legal frameworks in ESC countries are predominantly inadequate, limited in scope, and outdated.

Recommendation: Support national governments in strengthening legal frameworks for resilience. Support countries to review and update legislation to incorporate comprehensive disaster management, climate change adaptation, and a multi-hazard approach by:

- Supporting the development of mechanisms for implementation and enforcement, including securing and managing national and international funding (as addressed under Recommendation 4).
- Supporting national governments to develop and enact a risk-informed legal framework that prioritizes risk reduction and a resilience management system tailored to each country.
- Establishing national and international accountability mechanisms to ensure adherence to regulatory and institutional frameworks.
- Supporting countries in implementing fully participatory disaster risk management legislation, policies, and plans that empower communities and increase stakeholder buy-in.

STRENGTHENING CITIZEN AND COMMUNITY RESILIENCE

GAP AND RECOMMENDATION 6

Gap: Communities represent an enormous strength, they are pillars of ESC societies. Strong social dynamics and healthy, functioning ecosystems are critical to adaptive capacity and increase a community's and region's ability to respond effectively to chronic stresses and extreme events.

Recommendation: Strengthen local capacity for resilience. Support local capacity building and community-level resilient livelihoods, including nature-based solutions, by:

- Designing and implementing funding mechanisms to provide inclusive community-level support for comprehensive resilience building.
- Supporting community-based programs that build comprehensive resilience and support sustainable and inclusive economic development.
- Scaling effective community-based programs to build broader community-level resilience across communities and countries.

GAP AND RECOMMENDATION 7

Gap: Youth are particularly at risk of natural hazard impacts due in part to their limited voice and empowerment, lack of access to resources, and high unemployment. Simultaneously, across the ESC region, a lack of human capacity is cited as a significant barrier to disaster preparedness, response, and reconstruction.

Recommendation: Engage and empower youth to build resilience. Provide opportunities for youth as designers and leaders in programming interventions, empowering them in the development of initiatives that promote positive youth development, economic security and resilience, and new opportunities that build energy and food security by:

- Engaging youth in resilience planning, program design, and implementation, including ensuring youth are involved explicitly in climate change project design and providing support for youth groups to become more engaged in community-based disaster risk reduction activities and emergency response teams.
- Raising youth awareness about and mobilizing them to address climate change and risks through formal education, training, and targeted social media and celebrity campaigns.
- Training youth in the skills and technologies that support resilience building, such as in renewable energy technology, climate-smart agriculture, and education in science, engineering, information and communications technology, and planning.
- Increasing employment opportunities for youth and young professionals in resilience-related professions and occupations.

Photo by: Brian Yurasits on Unsplash
Barbados

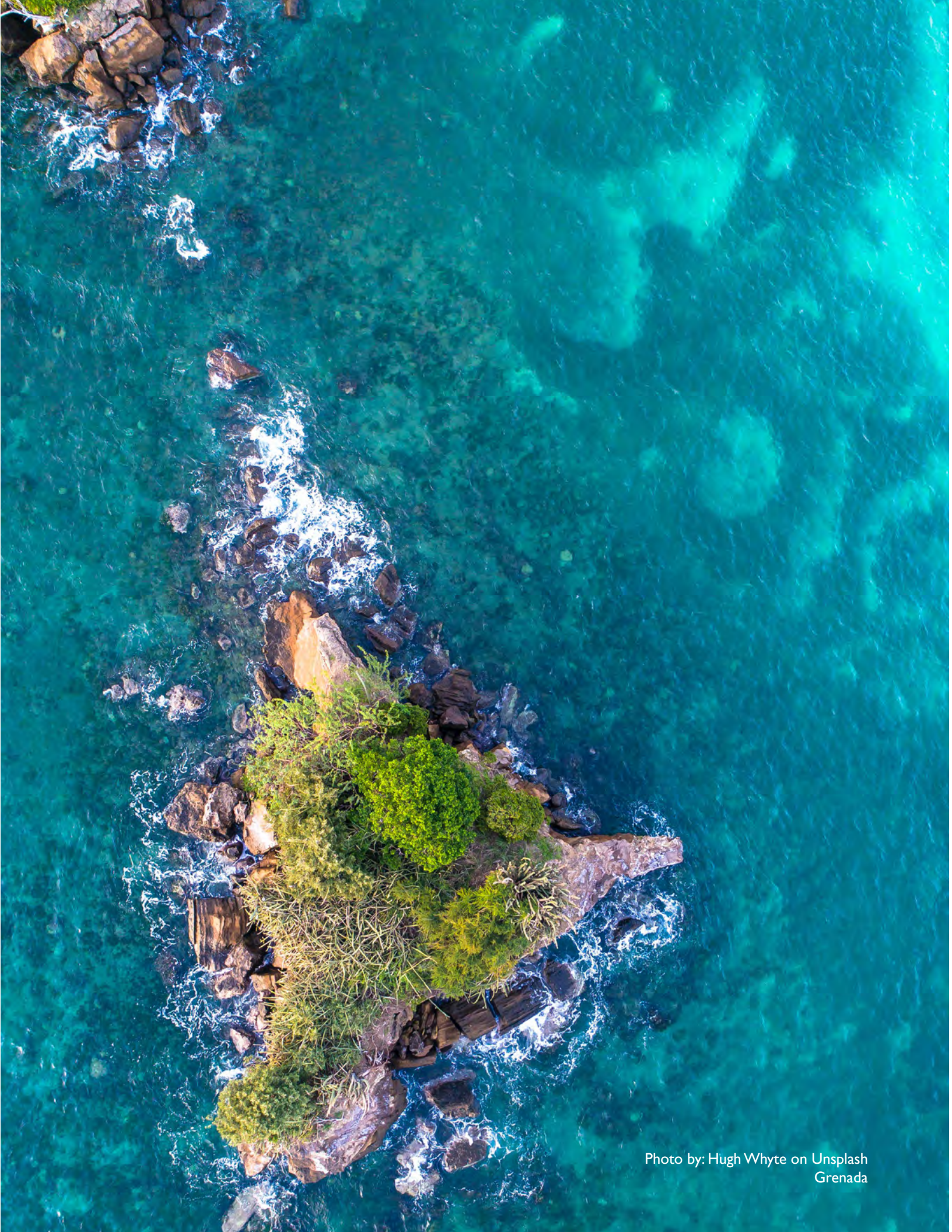

Photo by: Hugh Whyte on Unsplash
Grenada

1. INTRODUCTION

1.1 PURPOSE

The Eastern and Southern Caribbean (ESC) region is highly vulnerable to natural hazards. Between the years 2000 and 2017, countries in the Caribbean experienced an estimated $27 billion in losses and damages from natural hazards (Friar 2019). In addition, social and economic stressors such as the effects of poverty, inequalities, and a lack of economic diversification affect the ability to prepare for and respond to these risks. Projected increases in climatic variability and change in the coming years will continue to threaten livelihoods, public health and safety, natural resources, the built environment, and the financial stability and security of ESC nations.

Due in part to the existential threat of climate change to small island developing states (SIDS), Caribbean countries have a long history of leadership in support of more ambitious global climate action. More recently, the Caribbean Community (CARICOM) presented a bold vision to make the Caribbean the world's first climate resilient zone. Countries across the region are working to strengthen their resilience to these risks by strengthening their ability to anticipate, prepare for, and respond to natural hazards while building thriving, inclusive, and sustainable communities. However, achieving long-term resilience—moving beyond preparedness and response—remains a challenge. This is in part because the region is at risk from multiple hazards, occurring simultaneously or consecutively, resulting in compounding and cascading impacts requiring immediate action. To move towards longer-term resilience to natural hazards, the region needs a transformative development approach that incorporates a coordinated "multi-hazard" approach. The United States Agency for International Development (USAID) defines transformative capacity for resilience as fundamental shifts to the enabling environments for individuals, households, and communities to strengthen social, environmental, and economic systems in the face of hazards and stressors (USAID 2018b).

Figure 1. ESC countries where USAID operates.

The primary purpose of this report is to assess the resilience capacities of the ESC region from natural hazards and inform USAID/ESC regional programming. The assessment will inform USAID/ESC in the

development and implementation of its Regional Development Cooperation Strategy. USAID/ECS's development assistance in the region extends to eleven countries: Antigua and Barbuda, The Bahamas, Dominica, Grenada, Saint Lucia, Saint Vincent and the Grenadines, St. Kitts and Nevis, Barbados, Trinidad and Tobago, Suriname, and Guyana (Figure 1). This study considers the region as a whole and focuses on six nations in particular: Antigua and Barbuda, Saint Lucia, Grenada, Barbados, Trinidad and Tobago, and Guyana. This assessment may also assist USAID/ESC's partners and other stakeholders in the region who need a comprehensive and consolidated risk and resilience capacity assessment to inform programming across the region.

This assessment has been undertaken at a time when development partners are grappling worldwide with the need to bring together the knowledge of multiple disciplines working to build resilience. The current COVID-19 pandemic is heightening awareness of the complex interactions between public health, socio-economic conditions, and natural hazards. And the influence of climate change—particularly in countries already at high risk—compounds the challenge of creating sustainable and equitable communities and nations. Recognizing this imperative, in October 2020 the United Nations Office for Disaster Risk Reduction and the UN Framework Convention on Climate Change (UNFCCC) signed a Memorandum of Understanding designed to integrate approaches to disaster risk management and climate change adaptation to achieve greater resilience—to help countries move beyond the cycle of response and recovery to transformative resilience (UN Climate Change 2020). It is in this spirit that this assessment is being conducted—to understand the complexities of risk and risk management in the ESC and identify a path forward to greater resilience.

1.2 BRIEF OVERVIEW OF USAID REGIONAL PROGRAMMING

Resilience is a key component of USAID/ESC's regional strategy, aligning with regional and national priorities. The current regional strategy (2015-2019, extended until December 2020) includes a focus on reducing the negative impacts of climate change on vulnerable populations and natural assets through strengthening the use of climate science and analysis for decision-making and implementing adaptive resource management strategies. A keystone program included the recently completed four-year Climate Change Adaptation Program, implemented by the Caribbean Community Climate Change Centre (CCCCC), to strengthen the implementation and financing of sustainable adaptation approaches. In August 2020, USAID/ESC and the Caribbean Disaster Emergency Management Agency (CDEMA) launched the Caribbean Climate Resilience Initiative to further strengthen climate resilience through improved capacity of regional and national institutions and enhanced mechanisms and systems. USAID/ESC is also implementing a resilience activity in partnership with the Caribbean Institute for Meteorology and Hydrology (CIMH) to improve and strengthen systems to support early warning, disaster preparedness, recovery, and response. Another activity underway includes a partnership with Inter-American Foundation to strengthen disaster mitigation and resilience at the community level through grantmaking, capacity building, and knowledge exchange.

Other USAID and U.S. Government programs and initiatives in the region also inform USAID/ESC resilience programming. For example, the USAID Office of U.S. Foreign Disaster Assistance (now the Bureau for Humanitarian Assistance) funded the Regional Disaster Assistance Program, which funds technical assistance to national disaster organizations and first responders throughout the region. In addition, the Bureau for Humanitarian Assistance supports supply chain logistics and coordination for disaster preparedness and recovery—focused on getting humanitarian supplies to people in need. To address energy sector risks in the region, USAID/Dominican Republic developed the Caribbean Energy Initiative. This five-year initiative will boost the energy resilience of Caribbean island nations. Additionally, the U.S. Government launched the U.S. Caribbean Resilience Partnership in 2019, which brings together ten federal agencies—including USAID—and 18 Caribbean countries and CDEMA.

This partnership fosters the alignment of USAID/ESC programming with other U.S. Government activity in the region to collaboratively build regional capacity for resilience. The U.S. Military Liaison Office also supports projects that contribute to building resilience in the region, such as disaster relief training for CDEMA and installation of equipment for emergency operations centers.

USAID/ESC social services programming includes citizen security, education, democracy and governance, and public financial management. In particular, USAID/ESC programming has had longstanding focus on youth and citizen security. To date, programming for citizen security projects has focused on improving regional crime data systems, juvenile justice reform, youth-focused citizen security programs, and gender-based violence prevention. USAID/ESC has funded a project titled "Youth Empowerment Services," which is focused on reducing youth involvement in crime and violence by strengthening evidence-based decision-making; building community, family, and youth resilience; and spearheading a juvenile justice reform project. In the education sector, priority areas outlined by USAID/ESC include foundational literacy and numeracy, experientially based education and youth workforce development, and timely data to support strategic and programmatic decision-making. These initiatives support positive youth development and engagement, and contribute more broadly to citizen security.

This assessment is framed around ongoing and potential focus areas for regional programming in USAID/ESC's new five-year strategy which focuses on strengthening community resilience and improving government accountability and transparency. In particular, the report assesses the risk to, and resilience of, communities (including the built environment), youth and women, and key economic sectors (tourism, agriculture, water, biodiversity, and energy) to natural hazards. The assessment includes consideration of current and potential future impacts of natural hazards given the development context and current resilience capacities at the regional and national levels. These findings inform recommendations for USAID programming in disaster resilience systems, key sectors, communities, youth security, education, governance and public financial management, and the business enabling environment.

1.3 OVERVIEW OF ANALYTICAL FRAMEWORK AND ASSESSMENT PROCESS

The analytical framework for the risk and resilience assessment builds on the USAID Resilience Guidance Notes and USAID Climate Risk Management Tool. USAID defines resilience as the ability of people, households, communities, countries, and systems to mitigate, adapt to, and recover from shocks and stresses in a manner that reduces chronic vulnerability and facilitates inclusive growth. CDEMA defines resilience as "the ability of a system, community, or society exposed to hazards to resist, absorb, accommodate, and to 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" (CDEMA 2018, 3). These definitions are consistent in both their scale (i.e., spanning from people and communities to systems) and their intended outcome (i.e., the protection of lives and livelihoods). The core components of resilience require an understanding of the context, hazards, and stressors–as well as the existing resilience capacities and measures in place–to ultimately enhance the resilience of development outcomes.

The assessment team undertook an extensive desk review and stakeholder consultations to underpin the resilience assessment. The desk review and stakeholder consultations included a focus on regional scale studies, reports and regional stakeholders, as well as a more in-depth literature review and stakeholder consultations focused on six countries: Antigua and Barbuda, Saint Lucia, Grenada, Barbados, Trinidad and Tobago, and Guyana. The in-depth focus on these six countries provided more detailed findings to support the regional-level assessment.

The team reviewed more than 160 relevant reports and other documentation to identify climate and disaster impacts, resilience capacities, policy and institutional frameworks, the status of resilience efforts within the region, and gaps in the available information. This desk review consisted of documents from the substantial network of regional institutions, national-level information (e.g., legal documents including national laws and policies, country-level risk assessments), academic papers (e.g., peer-reviewed papers, state-of-the-art climate research from the Intergovernmental Panel on Climate Change (IPCC)), and reports and assessments to identify capacity gaps and challenges to inform investments (e.g., project documentation from donors or project concept notes for climate change adaptation).

In order to ground truth and fill in gaps from the desk review, the team held consultations with 65 stakeholders across the region, including representatives from regional organizations, national disaster offices and organizations, and line ministries. In addition, the team consulted with program implementers and experts from civil society organizations (CSOs), non-governmental organizations (NGOs), academia, and private sector organizations. Finally, the team consulted with USAID and other U.S. Government entities, as well as other donors (including bilateral and multilateral development banks and international financial institutions) active in resilience-related programming. Consultation details can be found in Annex B.

The team then triangulated and synthesized information from the desk review and stakeholder consultations to provide a regional assessment of risk and resilience capacity, building on the country-level assessments to provide examples from ESC countries. This report includes a region-wide synthesis of findings and recommendations, including notable nuances across countries. Profiles for each of the six priority countries are provided in Annex A. The team also developed a preliminary Climate Risk Management Matrix which summarizes significant climate risks, current adaptive capacity, potential opportunities, and risk management options, related to USAID's development objectives. This draft CRM Matrix, provided in Annex C, is a working document for USAID's further elaboration and use as it develops its Regional Development Cooperation Strategy.

2. REGIONAL CONTEXT

The high vulnerability to, and potential for, natural hazard impacts throughout the region drives direct integration of resilience capacity building into regional planning. However, development and capacity levels vary throughout the region. This section provides a high-level overview of the environmental, social, and economic context predominantly focused on the six focal countries, followed by a description of the institutional context and strategic resilience frameworks of the region.

2.1 ENVIRONMENTAL, SOCIAL, AND ECONOMIC CONTEXT

ENVIRONMENTAL

The five SIDS that are a focus of this assessment in the ESC have an average area of 458 km^2, although Trinidad and Tobago is a bit larger with an area of 5,131 km^2. The SIDS' topography varies from low-lying coral islands like Barbuda, with a maximum elevation of 42 m, to volcanic islands with mountainous interiors like Grenada, Saint Lucia, and Trinidad and Tobago. Guyana covers a vast landscape of about 215,000 km^2 on the South American mainland. In the Southwest region of the country, Mount Roraima has a peak of 2772 m nestled in the Pakaraima mountain range.

The SIDS lie on the easternmost edge of the Caribbean tectonic plate, whose movement is responsible for the region's volcanoes and earthquakes. Both Saint Lucia and Grenada have potentially active volcanoes, and all the neighboring SIDS can be affected by volcanic activity. Soils in the region range from fertile volcanic soil on islands like Saint Lucia and Grenada, to limestone and mixed soils on the lower-lying islands like Antigua and Barbuda and Barbados. Guyana's soils range from fertile alluvium and sandy soils along the coast, to rocky, infertile soils in the interior (Food and Agriculture Organization (FAO) 2015b). The country's ecosystems include wetlands, mountains, savannah, and rich tropical forests. Due to the environmental and geographic features of the region, natural hazards in the region include volcanic activity, earthquakes, tsunami, hurricanes, flooding (particularly urban flooding), landslides, and drought (CDEMA 2014).

The climate in this region is tropical, with a historically wet season of June to November, a dry season of December to May, and average temperatures of 28°C. The smaller island countries are most vulnerable to sea level rise and saltwater intrusion. Hurricanes and tropical storms frequently affect the region's northern islands, with three significant hurricanes and one tropical storm hitting the region in 2017 (USAID 2018a). Chronic and acute climate hazards, including climate change projections, are described in more detail in Section 3.

The Caribbean accounts for seven of the world's top 36 water-stressed countries, with Barbados in the top ten (Reig, Maddocks, and Gassert 2013). Barbados and Antigua and Barbuda are categorized as "water-scarce," with less than 1000 m^3 freshwater resources per capita (ibid.). The region already experiences drought events, which can impact agriculture and produce bush fires (FAO 2016a, b). Guyana, unlike the Caribbean SIDS, boasts ample water resources, and is one of eight countries sharing the Amazon Basin, although its sparsely populated inland regions do experience drought (Velasco 2014; FAO 2015b).

The Caribbean region is known as a biodiversity hotspot containing a wide range of marine and terrestrial ecosystems including coral reefs, seagrass beds, mangrove stands, lagoons, beaches, wetlands, moist forests, dry forests, and grasslands (OECS n.d.). Because of its relative isolation from the rest of the Caribbean region, ESC region countries are host to many endemic species.

SOCIAL

The total population of the countries of focus in this assessment is around 2,640,000, of which Trinidad and Tobago has the largest population at 1.4 million, and Antigua and Barbuda the smallest population at around 97,200 in 2019 (World Bank 2020g). The ESC focal SIDS have an average demographic composition of 85 percent of African descent, 7 percent mixed, with smaller minorities of East Indian, Hispanic, or European descent. Trinidad and Tobago and Guyana have demographics that reflect a more even split of 35 percent of African descent, 35 percent of East Indian Descent, 20 percent mixed, and 10 percent other. This demographic makeup across the region is a result of the introduction by European colonizers of enslaved Africans and indentured Indian servants, and the decimation of indigenous populations during the colonization process by disease and conflict.

There is a low population growth rate across the ESC focal countries, in part due to outward migration. The median age of the population of the focal countries is around 35 years old, similar to the global population median age. The percentage of the population residing in urban areas is relatively low, between 18 percent (Saint Lucia) and 36.5 percent (Grenada), and urbanization is not increasing significantly (World Bank 2020g). Trinidad and Tobago is an outlier, with 53 percent of the population in urban areas, mostly around the capital, Port of Spain. According to the IPCC, more than half the population in Caribbean countries lives within 1.5 km of the coastline (Mimura, et al. 2007), and 90 percent of Guyana's population lives in the coastal regions (Government of Guyana 2012).

Youth unemployment and crime rates are high in the ESC region (Evanson 2014). The Caribbean Development Bank's (CDB) Youth Employment for Sustainable Development Report (CDB 2015) found that almost a quarter of Caribbean youth are unemployed, one of the highest rates in the world, and that unemployment is ten percentage points higher for young women than for men. Estimates from CARICOM show that the "cost of gang-related crime is between 2.8 percent and 4 percent of gross domestic product (GDP) in the region due to the cost of policing and corrections, as well as lost income from incarcerated youth and reduced tourism demand" (2010, 124). Despite these troubling statistics, the ESC focal countries boast very high rates of literacy, with all nations reporting above 98 percent literacy, and most recent data showing high levels of lower secondary education completion rates (World Bank 2020e).

ECONOMIC

In the ESC region, the economy shifted over the past few decades from agriculture livelihoods to tourism and natural resource exports. In 2013, only 20 percent of the population was economically engaged in agriculture in Antigua and Barbuda, Grenada, Saint Lucia, and to a slightly lesser extent in Guyana. Trinidad and Tobago and Barbados had even smaller portions of their population engaged in agriculture, with 6 percent and 2 percent respectively (FAO 2015a, c).

The natural riches of the region, its beaches and coral reefs in particular, are key drivers of the tourism industry in all ESC island nations. The tourism industry is the largest single contributor to GDP in the ESC region SIDS, while the economies and employment opportunities in Guyana and Trinidad and Tobago are driven by the natural resource sectors of mining, oil and gas, forestry, and fisheries. The high reliance on tourism for income significantly amplified the effects of the COVID-19 pandemic on the region's economies. Caribbean countries are expected to face declines of around 10.3 percent in their GDP in 2020 as well as lose major government revenue from lost taxes (U.S. Library of Congress 2020; Handy 2020). Some countries, however, have kept their borders open, and others such as Saint Lucia and Barbados are even offering extended stay visas for foreigners to work remotely (Burleigh 2020 and stakeholder consultations).

The level of energy, food, and water resource security has economic implications. Trinidad and Tobago and Guyana both enjoy rich oil and gas deposits, although Guyana's reserves are only beginning to be exploited and Trinidad and Tobago's reserves have declined.

The plunge in oil prices due to the COVID-19 pandemic may have serious budget consequences for Trinidad and Tobago, in particular (Caribbean Council 2020). The other ESC focal countries import the vast majority of their energy (USAID 2017) and food, which has left them particularly vulnerable to the global transportation and trade disruptions that have occurred during the COVID-19 pandemic. The CARICOM Food Security and Livelihoods survey found that most respondents have changed their diet as a result of the pandemic, with nearly one third skipping meals, eating less, or going a day without eating (CARICOM 2020). CARICOM reports that across their member states, more than 60 percent of total food consumption is imported. Half of member countries import more than 80 percent of the food they consume, while Guyana is food sufficient (stakeholder consultations 2020). In Trinidad and Tobago, for example, National Flour Mills figures indicate a significant decline in rice production over the past 27 years, from 21,200 tons to 585 tons in 2019—despite the fact that local demand for the staple is 34,000 tons annually (Ewing-Chow 2019). The ESC focal countries boast high access to improved water and sanitation services across the board, all above 90 percent access, according to FAO Country Reports However, there is increasing pressure on these services by pollution and saltwater intrusion (FAO 2015a, b, c).

Antigua and Barbuda, Barbados, Grenada, and Saint Lucia suffer from a high percentage of government debt in relation to GDP (average gross debt 90 percent of GDP), while Trinidad and Tobago and Guyana are below average, with an average gross debt of 41 percent of GDP and 51 percent of GDP, respectively (International Monetary Fund (IMF) 2019). The debt of ESC focal SIDS poses a hurdle to these countries in meeting their development needs. Additionally, many of the region's countries are now classified as middle income, which limits access to international concessionary financing options and aid.

Poverty and employment rates vary across the region, although the data are not always consistent or comparable, and some data are outdated as many of these countries are undertaking census surveys in 2020. In the assessment's focal countries, poverty rates vary from 11 to 29 percent, with higher rates of poverty for female-headed households (O'Marde 2017; Evanson 2014; Charles 2014; Government of Saint Lucia 2019).

Unemployment numbers across ESC countries vary from 3.8 percent in Trinidad and Tobago to 29 percent in Grenada, with higher unemployment for women as compared to men across the region, and much higher rates of unemployment for youth (Government of Saint Lucia 2019; Browne 2020; Government of Barbados 2018; Government of Grenada and World Bank 2015; United Nations Development Programme 2019a, b, c, d, e). The concentration of women in lower paid jobs can be a source of vulnerability for this group, leading to increased unemployment and poverty levels (CDB 2020). Meanwhile, the rate of youth unemployment in the ESC region is acute, with levels ranging from 20 to 40 percent (USAID 2019b). Unemployment in Saint Lucia stood at 16.8 percent in 2019, compared to a youth unemployment rate of 31 percent (Government of Saint Lucia 2019). This brings adverse socioeconomic consequences, including loss of income, as well as reduced self-esteem; increased feelings of exclusion and alienation; and involvement in criminal activities (CDB 2020).

2.2 INSTITUTIONAL CONTEXT AND STRATEGIC FRAMEWORK AFFECTING RESILIENCE

The institutional structure for disaster risk management and climate resilient development is grounded in a network of regional and national organizations that work together to collect information, build knowledge and capacity, design and implement strategies, and mobilize resources. At the regional level, entities within CARICOM form the core of this institutional structure and include CDEMA, CCCCC, CIMH, Caribbean Meteorological Organization (CMO), CDB, and others. Higher education institutions associated with CARICOM include the University of Guyana and the University of the West Indies (UWI)—which houses disaster and resilience centers such as the Seismic Research Centre, Disaster Risk Reduction Centre, Centre for Environmental Management, and Centre for Environment and Resources Management. Non-CARICOM regional institutions engaged in resilience include the Organization of Eastern Caribbean States (OECS) and Caribbean Catastrophe Risk Insurance Facility Segregated Portfolio Company (CCRIF SPC) and the Pacific Tsunami Center's hub in Puerto Rico.

These institutions work 'at the regional level for national benefit,' to achieve economies of scale by combining resources and reducing transactional costs to meet member countries' needs. This is particularly effective when there is a common interest and where centralized investments can improve regional outcomes (e.g., meteorological infrastructure and information (CIMH), policy (OECS)). Many of the regional entities have formalized arrangements to work together. For example, CDEMA and CCRIF SPC are working together to strengthen linkages between comprehensive disaster management and risk financing. These regional institutions also work closely with national level entities, and with donors and development partners, to plan and implement programs on risk management and resilience.

National governments play a leadership role in disaster risk management and resilience activities in their respective countries, drawing on the technical resources from regional institutions. Specifically, for disaster management and climate change resilience, national ministries work closely with CDEMA and CCCCC, respectively. Given the cross-cutting nature of resilience, sectoral ministries—such as for agriculture, tourism, and economic development—may assume responsibilities for various components of disaster management and resilient development in their sectors such as forecasting, data collection, planning, and implementing programs and policies. In Guyana, for example, the country's hydrometeorological services are part of the Ministry of Agriculture, consistent with the significant role of agriculture in Guyana's economy and the sector's need for weather data and forecasts.

International institutions also play a role in the region to support resilience through development and disaster recovery. Development partners, including bilateral and multilateral donors and development banks, increasingly prioritize disaster and climate resilience into their programming and investments to support the region, as detailed in 3.2 Current Status of the Region's Resilience Programming. International institutions also provide humanitarian assistance following disasters. Figure 2 provides an overview of the relationships of national, regional, and international actors.

CARICOM's overarching vision for an integrated, inclusive, and resilient region guides the region to aspire to resilience and is captured in its strategy Building a Caribbean Pathway for Disaster Resilience in the Caribbean Community (CARICOM 2019). This strategic framework–also referred to as the Caribbean Resilience Framework–reflects a philosophy of broad, integrated resilience that recognizes the intersections between natural hazards and social and economic well-being. It defines five pillars

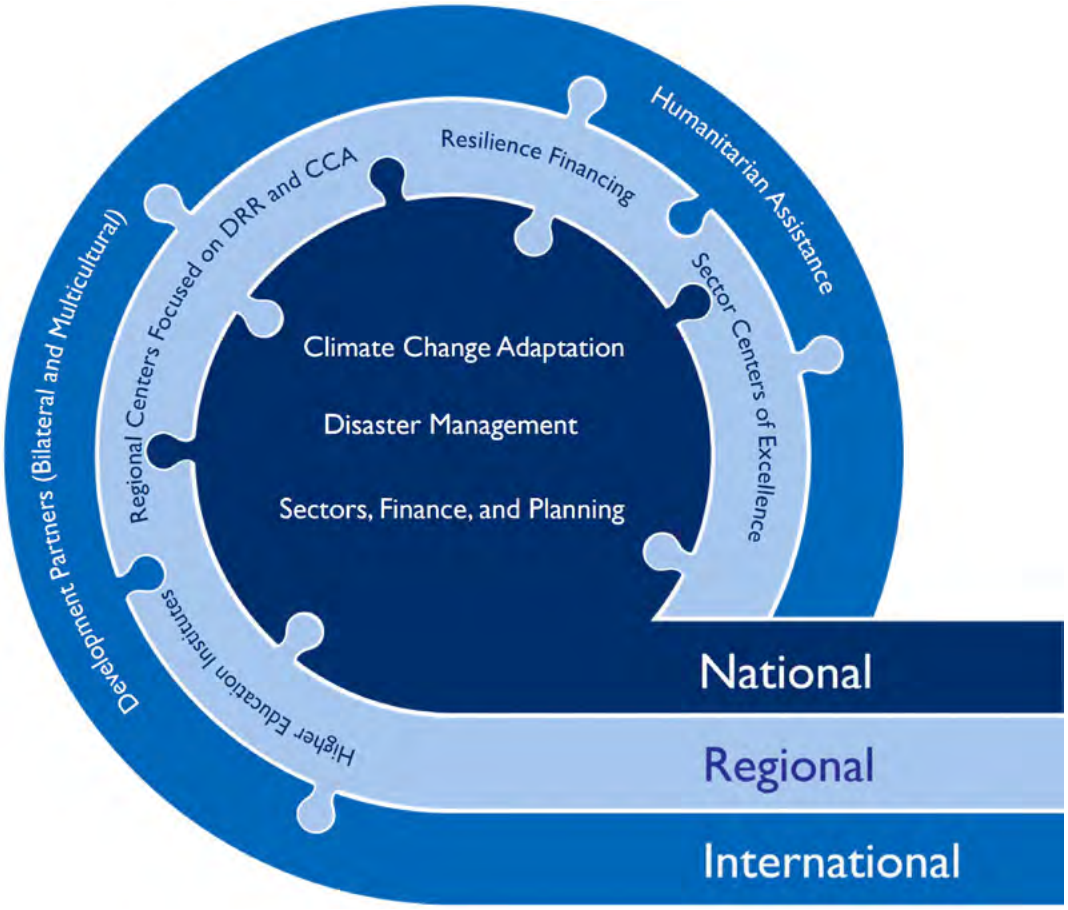

Figure 2. The Resilience Ecosystem: National, regional, and international institutions addressing risk and resilience.

of resilience: 1) social protection for the marginal and most vulnerable, 2) safeguarding infrastructure, 3) enhancing economic opportunity, 4) environmental protection, and 5) operational readiness. The framework then lays out key issues to be addressed to achieve each pillar of resilience. A key component of the USAID/ESC and CDEMA Caribbean Climate Resilience Initiative is to elaborate on the framework and develop an implementation plan. It is worth noting that while most states have unique needs that can only be effectively addressed at the national level, the framework and regional strategies for resilience are co-developed with strong participation of member countries and are aligned with member country goals for resilience.

Two authoritative regional strategies for resilience are CDEMA's Regional Comprehensive Disaster Management Strategy and Results Framework (2014–2024), and CCCCC's Climate Change and the Caribbean: A Regional Strategy for Achieving Development Resilient to Climate Change (2009–2015), which is currently being updated for 2020–2030. In line with the Caribbean Resilience Framework, CDEMA's comprehensive disaster management approach moves beyond a focus on reactive response and relief to longer-term resilience to climate change. Further, comprehensive disaster management emphasizes a holistic approach that embeds resilience considerations into every sector. Both the CDEMA and CCCCC strategies promote this integrated approach and feature common cross-cutting themes including coordination, capacity building, civil society participation, and gender inclusion. These two strategies–developed in partnership and consultation with member states–establish frameworks that guide the approach to resilience at both the regional and national levels to meet country needs. As shown in Figure 3, both strategies incorporate and align with member country, regional, and key international strategies on resilience.

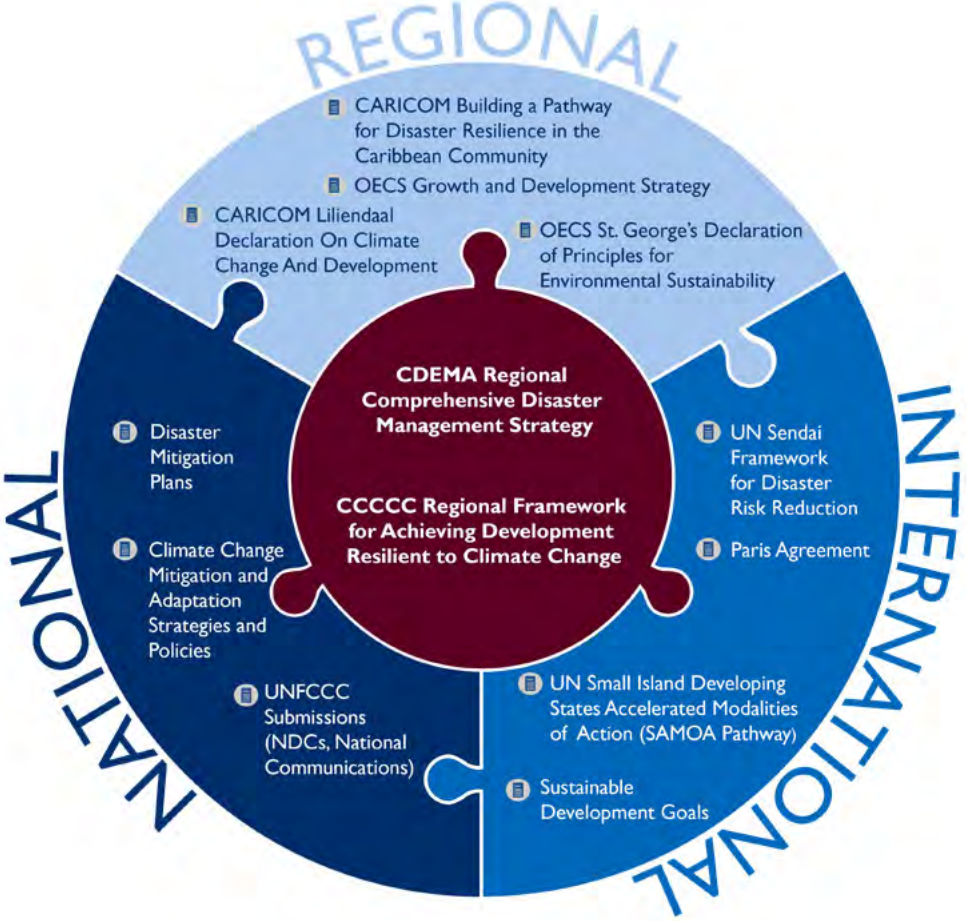

Figure 3. Key regional, national, and international strategies on resilience.

Some ESC countries have disaster-related policies in place, though they vary in coverage of disaster risk reduction and management approaches (Weeks and Bello 2019). Barbados' policies, strategies, and legislation have aligned with CDEMA's Framework for comprehensive disaster management since 2003. As another example, the Trinidad and Tobago Office of Disaster Preparedness and Management (ODPM) is working to draft their national disaster policies in direct alignment with CDEMA's framework. CDEMA developed a resource library of model policies that can provide a basis for countries to develop policies tailored to their institutional structure and resilience concerns. More information about the status of legislative policies is provided in Section 3.1.

SIDS have a history of active and vocal participation in international climate change dialogue. The Alliance of Small Island States (AOSIS), which includes all ESC SIDS and mainland countries such as Guyana and Suriname, play an important role in influencing the UNFCCC recognition that low-lying and other small island countries are particularly vulnerable to climate change. Notably, the AOSIS support of more ambitious global climate action including its call to limit the global temperature increase to 1.5°C, was instrumental during the UNFCCC Conference of the Parties (COP 21) negotiations. AOSIS has called for increased support for country-driven adaptation, including new financial resources. AOSIS is also a vocal proponent of international support for loss and damage, including the Warsaw International Mechanism for Loss and Damage associated with Climate Change Impacts and inclusion of the topic in the Paris Agreement. SIDS' needs and aspirations are also articulated through the SIDS Accelerated Modalities of Action Pathway, adopted in 2014 during the Third International Conference on SIDS.

3. RISK AND RESILIENCE ASSESSMENT

3.1 RISK AND RESILIENCE PROFILE

Risk is a function of natural hazards, human-induced stressors, impacts, and resilience capacities as shown in Figure 4 (Lavell, et al. 2012). Various types of natural hazards (e.g., extreme heat, hurricanes, earthquakes) differ in probability, frequency, and intensity. Climate change threatens to change characteristics of natural hazards through changing hazard frequency and intensity. Occurrence of natural hazards can result in impacts to people, assets, and systems, such as through damages to infrastructure, service disruption, or loss of livelihoods. Resilience capacity is the ability to cope with and respond to impacts. For example, low resilience capacity to respond to significant impacts from an intense and long-lasting drought hazard event reflects high risk. Human-induced stressors (e.g., poverty, land degradation) can affect risk by exacerbating the impacts of a natural hazard and constraining resilience capacities. Nevertheless, impacts and resilience capacity can change due to changing socio-economic and environmental conditions. Resilience programming can be best targeted by understanding these risk components.

The regional risk and resilience profile in this section consists of an assessment of naturally occurring hazards and human-induced stressors, their impacts on communities and key development sectors, and core resilience capacities. This assessment focuses on USAID/ESC's preliminary regional programming development goals and sectors and considers how these are at risk for current and potential future natural hazards. The components of risk are each described separately to better illuminate the underlying causes of risk. Building resilience capacity provides the foundational skills to make subsequent decisions on how to reduce impacts, and in turn risk.

NATURAL HAZARDS AND CLIMATE CHANGE

The ESC is exposed to an array of acute and chronic natural hazards. A hazard is a physical event or trend that may adversely affect people or infrastructure. Acute natural hazards, which manifest as extreme events, include extreme heat, dry spells, hurricanes, extreme precipitation, storm surge, volcanic eruptions, earthquakes, and tsunamis. Chronic natural hazards, which manifest as long-term, gradual changes in conditions, include changes in temperature, drought, precipitation change, sea level rise, and ocean warming and acidification. Changes in chronic hazards (e.g., sea level rise, increasing temperature) can increase the intensity or frequency of acute hazards (e.g., storm surge heights, extreme temperatures). In addition, acute and chronic natural hazards contribute to secondary hazards, including flooding from storms, chronic 'sunny day' coastal flooding, landslides, wildfire, pests and diseases, and dust storms.

ESC countries are exposed to a broad range of acute and chronic hazards, with some differences in occurrence and frequency related to geographic location and topography. For example, Trinidad and Tobago and Saint Lucia experience rainfall-induced landslides due to their mountainous terrain. On the other hand, Antigua and Barbuda's relatively flat terrain leaves the two-island state more exposed to static pooling after storms (O'Marde 2017). Relative to large mainland countries such as Guyana, impacts to already limited water supply on the smaller island countries due to changing rainfall patterns can have significant economic and health effects. The region's northern islands are more frequently affected by hurricanes and tropical storms due to their geographic location. Historical hazards that have impacted ESC countries are further described in CDEMA's disaster risk reduction country risk profiles. Earthquakes are a constant threat, because the ESC region is in close proximity to the active Caribbean tectonic plate boundary, and the densely populated coastal areas are especially at risk from tsunamis. Despite a low frequency of occurrence, tsunamis are generally perceived as high-risk, due to potential high consequences. For the countries that do face seismic hazards, eruptions, and earthquakes

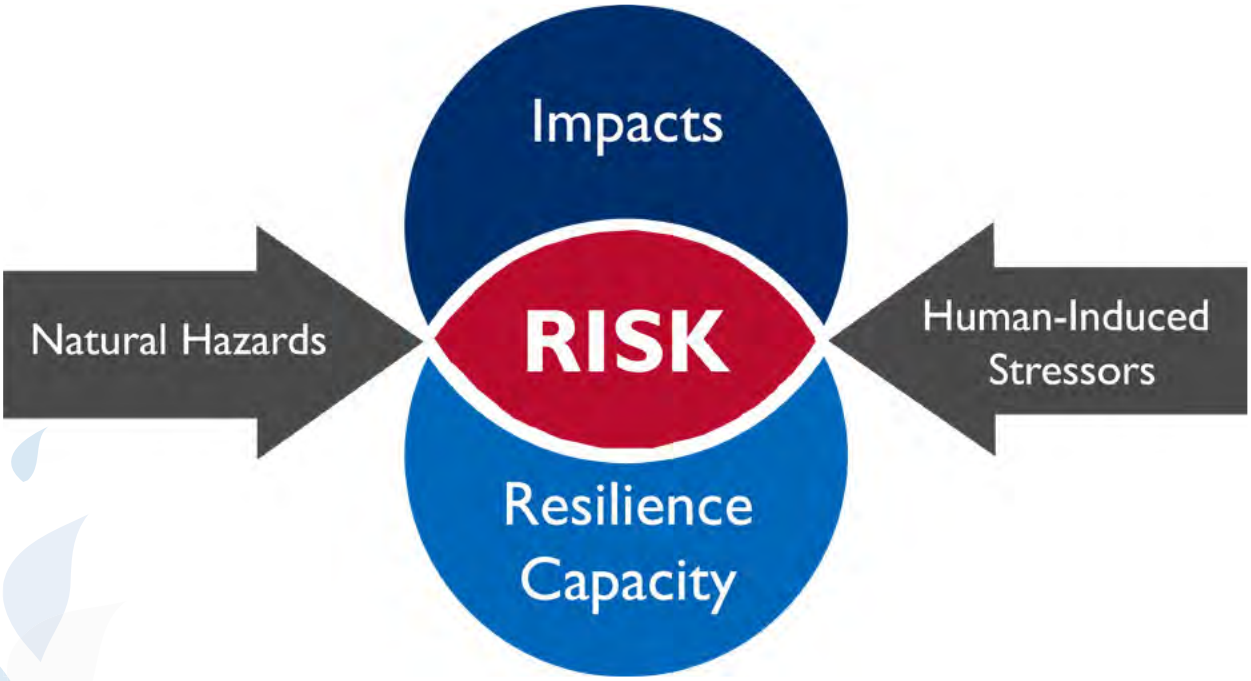

Figure 4. Risk as a function of natural hazards, human-induced stressors, impacts, and resilience capacities.

INTRO
REGIONAL CONTEXT
RISK AND RESILIENCE ASSESSMENT
RESILIENCE AREAS FOR POTENTIAL PROGRAMMING
GAPS AND OPPORTUNITIES
COUNTRY PROFILES
ORGANIZATIONS CONSULTED
CLIMATE RISK MANAGEMENT MATRIX
REFERENCES

themselves cause damage and trigger secondary impacts such as landslides. Throughout the region, there is a high incidence of low magnitude earthquakes; however, major destructive earthquakes with magnitudes greater than 7.0 rarely occur in the ESC. Within the last 100 years, Trinidad and Tobago experienced the highest incidence of major earthquakes, including in 2018 and 1997. Antigua and Barbuda is also in a seismically active zone—close to the epicenters of two of the three largest quakes recorded in Caribbean history. Seismic hazards represent a moderate to low risk for Grenada, which has a history of earthquakes and active volcanoes on the island. The submarine active volcano Kick 'Em Jenny is located five miles off the north coast of Grenada and its eruption could trigger a tsunami (Smithsonian Institution 2020). Barbados experienced only ten earthquakes and seven tsunamis between 1670-2014, making tsunamis the least frequently recorded natural hazard for the country. Guyana is less exposed to volcanoes or earthquakes than the small island states, as the country is located relatively far from the South American tectonic plate edge.

The likelihood of tropical storms and hurricanes making landfall in the ESC is significantly higher than the incidence of earthquakes. Historically, tropical storms and hurricanes are two of the most frequent natural hazards that impact the ESC region. Due to their frequency, tropical storms and hurricanes are a natural part of the region's cycle of life. Indeed, the region was hit by three significant hurricanes and one tropical storm in 2017 alone.

El Niño-Southern Oscillation is an important source of climate variability in the tropics. El Niño events are associated with hotter, drier conditions and historically drive drought in the Caribbean. La Niña events are associated with cooler, wetter conditions. For example, Guyana's hydrometeorological services indicate that regular droughts take place across the country and show a strong correlation with El Niño conditions, while the country experiences heavy rainfall during La Niña events (Velasco 2014). El Niño conditions suppress hurricane activity, while La Niña conditions enhance hurricane activity in the region.

Over the past few decades, climate conditions changed across the ESC region. The number of hot days in the region (i.e., days above 31.8°C) is increasing, even on leeward sides of islands sheltered from trade winds (OECS 2020). Changes in rainfall in the recent past were more variable across the region, with reductions in some countries and increases in others (e.g., Guyana). In the Atlantic basin, of which the Caribbean is a part, tropical storm activity has been in a high-activity era since the mid-1990s, which is expected to continue.

Climate change projections for the region through the mid-century include the following:

- An acceleration of warming trends, with projected increases in both average and extreme temperatures. By mid-century, over 80 percent of Caribbean summer days (May–October) are projected to be hot days (i.e., days above 31.8°C), compared to the 50 percent of summer days observed in the recent past (OECS 2020).
- Variable changes in average annual rainfall across the region. Consistent with an overall drying trend, models project an increasing drought risk for Caribbean SIDS (Hoegh-Guldberg, Jacob, and Taylor 2018). Yet, rainfall intensity is also projected to increase across the region and as a result, flash flood severity could increase as well (OECS 2020; McLean et al. 2015).
- Intensifying rainy seasons and tropical storms. Rainy seasons and extreme precipitation associated with tropical storms are projected to intensify and may intensify flooding (OECS 2020). The strongest tropical storms in the region are likely to become stronger, with higher maximum wind speeds (OECS 2020).
- Rising seas. Sea levels in the region are projected to rise by 27 to 30 cm by 2050 (OECS 2020). Sea level rise is expected to exacerbate storm surges and coastal flooding and erosion.
- Increasing ocean temperatures and acidification. Projected changes in the ocean system include increases in both surface temperatures and ocean acidification (OECS 2020).

HUMAN-INDUCED STRESSORS

The ESC region experiences an array of acute and chronic human-induced stressors that can exacerbate the impacts of a natural hazard. Chronic stressors include poverty, gender-based violence, crime, and social exclusion and discrimination. Acute stressors include population pressure and land degradation. These stressors can interact and compound impacts from each other. For example, in Barbados, land conversion from agriculture to residential and commercial development has increased the coverage of impervious surfaces, triggering greater surface runoff and flash flooding (Evanson 2014).

High unemployment, especially among youth, leads to lack of income, increased feelings of exclusion, the desire to emigrate, and involvement in crime and violence (CDB 2020). Disaster-related impacts can result in the loss of employment for both men and women. The loss of ability to provide for their household may be more demotivating for men than women, and may lead to increase in inappropriate coping mechanisms such as drinking, as observed in other islands (USAID 2013).

The region experiences high levels of gender-based violence against women and young girls. According to the 2012 UN Development Programme (UNDP) Caribbean Human Development report, roughly 30 percent of Caribbean women report high rates of fear of sexual assault (UNDP 2012). This fear is not unfounded; while the worldwide population-based average for rape is 15 victims per 100,000 people, in Saint Vincent and the Grenadines that rate stands at 112, in Barbados it is 25, and in Trinidad and Tobago it is 18. UN Office on Drugs and Crime data from 2016 on female homicide and intimate partner homicide rates found that three ESC countries recorded the highest rates out of ten countries in Latin America and the Caribbean (LAC): Trinidad and Tobago (2.2 victims per 100,000 people), Barbados (2.0 victims per 100,000 people), and Grenada (1.9 victims per 100,000 people). It is likely that the actual rates are higher, as underreporting of gender-based and intimate partner violence is widespread. In 2019, USAID supported a gender-based violence survey in Guyana which showed that more than half of all women (55 percent) experienced at least one form of violence and 13 percent experienced abuse before the age of 18 years.

The countries in the region—particularly Trinidad and Tobago and Guyana—receive migrants due to political instability and poverty in Venezuela (UNICEF 2019a). A recent assessment found Trinidad and Tobago nationals and Venezuelans possess social resilience capacities, though a lack of social bonding across the populations hinders integration and exacerbates discrimination (Democracy International, Inc. 2019). This population influx also poses added challenges for countries attempting to manage COVID-19. Furthermore, there is potential for additional migration into ESC from Haiti in the near-term due to poverty.

IMPACTS

Hazards can directly or indirectly impact core sectors and their services, including human settlements and built infrastructure, energy, water, agriculture, tourism, and biodiversity and natural resources. Direct impacts include those that disrupt efficiency and performance of services (e.g., direct damage to infrastructure from extreme weather or seismic activity) while indirect impacts include those that are triggered by the initial event and cascading effects (e.g., rising temperatures increase the net electricity demand for cooling). These impacts often occur in rapid succession, leading to compounding downstream impacts for customers and interconnected sectors. For this reason, it is vital that disaster risk managers understand and account for the interactions and feedback loops among natural hazards and human-induced stressors, as well as the sensitivity of relevant assets and communities to compounded or cumulative impacts.

This section focuses on impacts to communities and the built environment and key sectors, including energy, agriculture and fisheries, water, tourism, and biodiversity and natural resources.

COMMUNITIES AND THE BUILT ENVIRONMENT

High density, informal settlements are often located in hazard prone areas (e.g., coastal flooding and landslides), where poverty and lack of land tenure can lead to poorly constructed housing. Human settlements and infrastructure are concentrated in coastal zones in the ESC, which are most exposed to strong winds, flooding and erosion from storms, and sea level rise. A significant proportion of families in the region do not have the means to 'hurricane-proof' their homes or invest in other preparedness and resiliency measures (UNICEF 2019a). Therefore, when a Category 4 or 5 hurricane makes landfall, many homes are destroyed, people have no insurance to recoup the damages, and the Government may not have the capacity to adequately respond to the aftermath of the storm. Coastal communities and infrastructure risk increased loss and damages, displacement of communities, permanent migration, and diminished income from tourism activities. Displacement and migration can lead to deterioration of the social and cultural fabric of community. In addition to the risks faced by coastally located communities, landslides can cut off small communities in more remote mountainous areas, as reported in Saint Lucia.

Women, youth, and children from low-income households are particularly at risk from natural hazards and climate-related impacts (Giannoni et al. 2012). At-risk youth are particularly vulnerable to natural hazard events, given they have fewer resources and connections to established networks for support than adults. Young children also face increased vulnerability to natural hazards, including displacement, disruption to schooling, susceptibility to water and vector-borne disease, and heat stress (UNICEF 2017). Many health impacts (e.g., vector-borne diseases and heat stress) are projected to increase under a warming climate (OECS 2020).

Critical infrastructure, including water supply and sewer systems, transportation networks, education facilities, health services, and energy structures, is also sensitive to tropical storms, hurricanes, and seismic events. For example, Hurricane Ivan devastated Grenada's built environment, damaging 70 percent of the tourism infrastructure and more than 80 percent of the public and commercial buildings (Charles 2014). Grenada's indirect losses from Hurricane Emily in 2005, such as revenue declines from business interruption, supply chain impacts, and temporary unemployment, amounted to $7 million (World Bank 2017). Grenada's population and assets are concentrated in its coastal capital, St. George's, which increases risk of life and livelihood to hydrometeorological hazards (World Bank 2017). Seismic hazards can also severely damage critical infrastructure. Indeed, Barbados is in the top 10 countries worldwide at risk of maximum loss of capital from earthquakes (Evanson 2014). Given the infrequency of seismic events, the region's population and building stock are less prepared for such hazards. In particular, port infrastructure is at risk of damage and disruption, which can have severe economic impacts and disrupt disaster response, especially for SIDS. When Hurricane Maria hit Dominica in 2017, a combination of physical damage, limited storage space, and procedural shortcomings created major difficulties for managing the surge in container traffic as disaster relief arrived (World Trade Organization (WTO) 2019).

In addition to impacts from acute hazards on communities and infrastructure, extreme heat is a 'hidden' hazard in the region. Average and extreme temperatures are projected to increase with climate change, which can impact public health as well as the economy and infrastructure. Increased heat waves can heighten the risk for heat illness and even heat-induced death (USAID 2018a). Increased temperatures can also increase the rate of wear and tear on built infrastructure and equipment, which can lead to increased costs for maintenance and repair of both public and private investments and decrease the serviceability of facilities. Increased temperatures also increase the demand for air conditioning, which can heighten the burden of energy costs for government infrastructure (and, therefore, taxes).

In addition, COVID-19 exacerbated impacts to communities from natural hazards in myriad ways:

- Reduced incomes to prepare households for potential hazard events, as jobs and income from tourism evaporated due to stringent travel restrictions.
- Increased food insecurity as supply chains are disrupted.
- Increased competition for scarce land and water as citizens revert to agrarian livelihoods.
- Limitations on shelter, and in the event that common shelter is needed, people may be exposed to COVID-19.

ENERGY

Most countries in the region are highly depend on imported fossil fuels, resulting in high energy costs. The high costs of energy impede economic development across all sectors, and disproportionately affect poorer households (WTO 2019). For example, Guyana lacks adequate agricultural processing plants to process crops for export, largely because energy is too expensive. Produce processing therefore happens in Trinidad and Tobago, where energy is much cheaper because they are a major producer and exporter of liquified natural gas and oil. Guyana recently discovered important oil reserves, but infrastructure for production is in the early stages of development and the country continues to depend on imported oil (Stakeholder Consultations 2020, Espinasa and Humpert 2013). The vulnerability of supply and high costs of energy both reduce the energy security and resilience of ESC nations.

The high dependence on imported fuel across most of the region exposes many countries to supply chain risk. Hurricanes and seismic activity disrupted supply chains in the past, delaying or limiting seaport-based imports. Earthquakes can cause electric and communication transmission and distribution infrastructure to fall, rupturing gas lines, and toppling flammable or toxic substances (UWI 2011). In addition, energy reserves located in the coastal zone are at risk of direct damage from tropical storms and storm surge. Damage to coastal roads can also disrupt supply chain distribution, and damage to roads with low redundancy can delay reconnection of remote communities after an event. Many countries have experienced oil spills and developed oil spill contingency plans. In the region's Disaster Risk Reduction Country Reports (United Nations 2017), oil spill is listed as a low frequency, high-impact risk.

Natural hazards also threaten the reliability of electricity generation, transmission, and distribution systems. Hurricanes and tropical storms can damage or destroy both overhead and underground systems. Some countries, such as Barbados, are working to protect utility infrastructure from strong winds by moving higher exposed networks underground (Stakeholder Consultations 2020). Flooding, particularly by saltwater from sea level rise and storm surge, can inundate and damage underground infrastructure. Hurricanes Irma and Maria's devastating impacts on Puerto Rico's power grid in 2017 highlight the need for building energy resilience in hurricane-prone regions. More than 1 million customers lost power during Irma. Then, 100 percent of customers were without power during Maria, followed by a slow rebuild period (National Academy of Sciences, Engineering, and Medicine 2020). Implications for rooftop solar also pose challenges; Hurricane Maria damaged nearly all roofs on Dominica (U.S. Library of Congress 2017). Additionally, a significant increase in the amount of Saharan dust coming across the Atlantic decrease the output of solar panels from the settled particulates (Stakeholder Consultations 2020). High temperatures affect the efficiency of energy system components, including solar and wind power, overhead lines and transformers, while simultaneously increasing peak cooling demands, stressing energy systems.

Climate change threatens to exacerbate climate risks to energy infrastructure and services, with impacts such as compromised energy efficiency, system performance, and infrastructure integrity (USAID 2018a). For example, changes in wind intensity associated with stronger hurricanes, threaten rooftop

solar and overhead lines. Increased temperatures and acute heat waves both reduce power system efficiency and capacity and increase the demand for cooling, further straining the power system and increasing the risk of brownouts and blackouts. In Guyana, poor quality electricity networks result in frequent outages, and a higher sensitivity of the system to natural hazards; while not all past outages relate to natural hazards, intense rainfall, winds, and flooding have disrupted power supply in the past (Guyana Times 2016). Smaller firms face larger impacts from these service disruptions, with estimated average losses of up to four percent of their total sales.

To combat these problems, several countries have made ambitious climate change commitments, with plans to increase energy efficiency and expand renewable energy to both reduce greenhouse gas emissions and increase energy security (McIntyre 2016). There is a high potential for solar photovoltaic energy. For example, Barbados' flagship climate change resilient program 'from roofs to reefs', dedicates $1billion (2 percent of GDP) over the next 10 years towards building resilience and moving towards net-zero carbon emissions by 2030. The plan indicates that 150 household roofs will be fortified for solar PV, which will be complemented by wind investments to provide 750MW of distributed energy resources. If these investments do not account for increasing intensity of winds and storms in their design, they will be more sensitive to exposure to natural hazards. Geothermal energy is also an opportunity in some countries; for example, Dominica could become a regional energy hub, transmitting excess supply produced from geothermal sources to neighboring islands and earning considerable royalties from electricity exports (WTO 2019).

AGRICULTURE AND FISHERIES

Agriculture represents a small percentage of economic output in most ESC countries, with Guyana (a net food exporter) as an exception. However, subsistence agriculture and fisheries are critical contributors to nutrition and livelihoods across the region. The agriculture sector faces significant challenges, including small farm sizes, high labor costs, aging farmers, poor soil, and a lack of diversity of crops. In addition, agricultural inputs such as water, electricity, and fertilizer tend to be quite costly, which lowers the competitiveness of local products compared to imports developed in larger economies of scale (Evanson 2014; USAID 2018a). In the wake of COVID-19, which decimated tourism income and increased food security concerns, many countries in the region are experiencing a resurgence in "backyard farming" to supplement food security. This increase in agricultural activity is cited in some stakeholder consultations as leading to increased tension and competition for scarce land and water (e.g., Barbados); at the same time, it is an example of resilience and adaptation in this challenging time. Stakeholders point to the need to increase investments in agriculture—both to diversify the economy and to improve food security by reducing dependence on imports.

The agriculture sector in ESC countries endures a range of impacts due to acute and chronic climate hazards. Water scarcity impacts the productivity of rain-fed agriculture in many of the small island countries, especially Barbados, Trinidad, and Grenada. Guyana's low-lying coastal agricultural areas (approximately 6 feet below sea level) face persistent flooding, requiring significant resources to manage drainage and irrigation systems. Unseasonal heavy rainfall can cause breaches and overtopping of irrigation infrastructure, and low water levels can produce tension cracks that can develop into major breaches (Velasco 2014). Grenada is experiencing new emerging diseases affecting crops associated with a warming climate. In addition, higher temperatures and changes in rainfall patterns require irrigation to be installed in places where it used to not be required. The 2017 hurricanes destroyed almost all crops on the affected small islands, requiring re-planting for the season. Heavy rains and flooding can lead to soil erosion, nutrient leaching, and damage to farm equipment, storage, processing facilities, and roads.

Projected climate changes threaten the agriculture sector in several ways. More intense rainfall and wind events could increase the frequency and extent of crop failure, soil erosion, and nutrient

leaching. Projected reductions in rainfall and increased temperatures could result in annual losses of agriculture GDP for Guyana, which is particularly dependent on the sector. Sea level rise and saltwater intrusion can increase salinity and reduce crop productivity in low-lying areas (USAID 2019b). Shifts in temperature and precipitation patterns can make current soil-based agricultural crops, livestock species, and fisheries less viable in the future as growing seasons change and agriculture and habitat climate suitability zones shift. Overall, these impacts decrease already low food security in the region and threaten livelihoods that are dependent on agriculture and fisheries.

As with land-based agriculture, fisheries in the region make a small contribution to GDP but serve important roles with respect to local communities' sustenance and traditional livelihoods. However, illegal, unreported, and unregulated fishing causes economic and social losses for ESC communities and may negatively impact their food security. Moreover, fisheries laws and regulations that are in place are often outdated and governments lack the economic policies that would allow for effective enforcement of these regulations (FAO 2014). Guyana and Barbados face threats to marine biodiversity from overfishing (Velasco 2014). In Saint Lucia, near-shore fisheries and coral reefs have experienced losses due to high levels of sedimentation and other land-based pollutants, as the steep topography, seasonal high rainfall, and unplanned human settlement and development along the coastlines lead to erosion and flushing of pollutants into the bordering coastal ecosystems (Thomas-Louisy 2014).

These human-induced stresses on fisheries and marine ecosystems are compounded by natural hazards. The presence of sargassum seaweed is a recent costly issue for many small island states. Sargassum is harmful to some fish species and corals, depletes fish stocks, and negatively affects tourism (see more in the Tourism Section). Sargassum also leads to reef death, which reduces coastal protection and causes coastal erosion (Dutch Caribbean Nature Alliance 2018). The role of warming temperatures and climate change on sargassum blooms remains an open scientific question.

The fisheries sector is already suffering climate-based impacts. Floods and hurricanes caused losses in the fisheries sector in Barbados and Grenada. In 2004, Hurricane Ivan caused $20.3 million in damage and in 2005, Hurricane Emily caused $13.1 million in damage to the agricultural sector (including fisheries) in Grenada (Charles 2014). In the region, tropical fish are already beginning to move poleward, and coral reefs are bleaching as a result of warmer ocean temperatures (USAID 2018a).

Future climate threats to fisheries in the region include increased ocean temperatures, ocean acidification, and increased intensity of storms. Warmer ocean temperatures lead to coral bleaching, which causes death of coral reefs around the islands. These reefs serve as critical habitats supporting the region's fisheries, including high value catch species such as spiny lobster and conch. Another critical habitat for marine life—mangroves—is threatened by sea level rise. Ocean acidification endangers reefs as well as the shellfish that are important to local fisheries economically and as a food source.

Both agricultural and fishery infrastructure are also vulnerable to climate impacts. Increased storm intensity and frequency will likely damage farming equipment, fishing boats and nets, storage facilities and transport systems (USAID 2018a).

WATER

Freshwater availability is a significant factor in economic and social development. The water sector underpins many key sectors in the region, including public health, agriculture, and tourism. In addition, there is a strong interdependence between the energy and water sectors—water is used for cooling energy infrastructure, and energy is needed to pump, purify, desalinate, and transport water. As noted in Section 2.1, freshwater resources quality and quantity vary widely between countries. Countries such as

Guyana benefit from plentiful freshwater resources from river systems, while many of the SIDS rely on rainwater. Barbados, for example, has no major rivers or surface streams and is particularly vulnerable to water scarcity. As mentioned in the Agriculture Section, some countries in the region currently face limited water resources; this scarcity is projected to worsen with climate change.

ESC countries currently experience threats to water resource quality and quantity. Water quality is impacted by issues such as saltwater intrusion, poor sanitation infrastructure, and pollution, while water quantity is impacted by groundwater extraction and increased urbanization, which expands impervious surface area and thus reduces the capacity for groundwater recharge. Barbados and Guyana experience saltwater intrusion due to lower observed levels of precipitation coupled with groundwater over-extraction. In Trinidad and Tobago, rapid urbanization resulted in insufficient drainage infrastructure and an increase in impermeable land surfaces, resulting in storm water running off rather than permeating into groundwater aquifers. ESC countries also experience reduction in water resources due to drought. Previous droughts resulted in water rationing in Guyana and measures to charge farmers for water extraction from certain rivers in Trinidad and Tobago. In Saint Lucia, the government declared a water emergency in May 2020 due to severe drought conditions and low water levels in the island's sole reservoir (Peter 2020). Seismic events can also damage water infrastructure, such as through the cracking or collapse of dam walls or damage to storage and distribution infrastructure (UWI 2011).

Climate change exacerbates risk to the already stressed water sector. In Guyana, projected sea level rise and subsequent saltwater intrusion threatens the nation's high dependence on coastal aquifers. As the frequency and intensity of storms increase with climate change, water and sanitation infrastructure damage will become more common. Projected increases in severe storms and hurricanes may also lead to intensified floods and landslides, which can contaminate freshwater resources and overwhelm water infrastructure and catchment systems. Most ESC nations expect to see further reductions in annual rainfall in the coming years and greater periods of drought. This has significant implications for the availability of freshwater for human consumption and for sectors such as agriculture and tourism. Contamination or reduction of available water has human health impacts, and a limited water supply would hurt the tourism sector (and therefore the economy) by making it more difficult to provide water for human consumption as well as services such as restaurants, laundry, recreation (e.g., swimming), etc. Because much of the agricultural land in these nations is rainfed, water scarcity could result in food insecurity in future years (FAO 2016b).

TOURISM

Tourism is a major and growing source of revenue in the region. As such, impacts to this sector have far-reaching consequences throughout communities. Reductions in tourism-based GDP will also reduce government funding, necessary for providing basic services and implementing disaster management and other critical programs. The COVID-19 global pandemic shows this in painful detail. As borders close and tourists are more wary of travel, reduced tourism revenues profoundly impacted ESC national economies.

The Caribbean is the world's most tourist-dependent region (Thomas 2015), and also one of the most vulnerable regions globally to the negative impacts of climate-related shocks and stressors. Coastal hotels, roads, and other tourism-supporting infrastructure are vulnerable to damage from more severe storms and hurricanes, sea level rise and storm surge, and accelerated coastal erosion. Damage to this infrastructure is disruptive to the economy for as long as the infrastructure is out of service, while also decreasing tourism demand due to perceived or real vulnerability to climate hazards. When Hurricanes

Luis and Marilyn struck Antigua and Barbuda in 1995, nearly all tourist resorts were damaged, tourist arrivals fell by 17 percent, and 7,000 people were left unemployed (Union of Concerned Scientists (UCS) 2011). In addition, the natural resources (e.g., coral reefs, fish diversity) and coastal beaches that normally attract tourists to the Eastern and Southern Caribbean region face threats from these natural hazards (see the discussion on biodiversity). Tobago's largest coral reef, Buccoo Reef, is a key driver of tourism to the country and has already been damaged by coral bleaching (Hutchinson-Jafar 2011). The erosion of beaches due to storms and sea level rise also threatens popular tourist destinations across several ESC countries.

Tourism in the Caribbean may suffer due to projected increases in atmospheric and sea surface temperatures, beach erosion, deterioration of reef quality and greater health risks (Economic Commission for Latin America and the Caribbean (ECLAC) 2011). Precipitation patterns and storms are also projected to become more frequent and intense, increasing weather unpredictability and threatening demand for tourism. In Barbuda, an island with low topography and existing vulnerability to beach erosion, every ten millimeters of sea level rise translates to 1 meter of lost land. By the end of the century, Antigua and Barbuda is projected to experience a shoreline retreat of about 40 meters, a loss that would severely affect 9 percent of major resorts on the islands (UCS 2011). Over 90 percent of the approximately 6,000 hotel rooms in Barbados are built on the coast, less than half a mile from the high-water mark and less than 20 meters above mean sea level. Storm surge models suggest that currently, over 50 percent of total rooms may be vulnerable in the event of a Category 3 hurricane, representing about $330–550 million to replace (ECLAC 2011). In Grenada, 1 meter of sea level rise by the end-of-century (Strauss and Kulp 2018) could affect 73 percent of major resorts along the coastline and 40 percent of seaport lands (Government of Grenada 2017). Natural resources and biodiversity are also projected to be further impacted by changing climate conditions. In Barbados, two meters of sea level rise would reduce the number of sea turtle nesting sites by 30 percent, and five meters of sea level rise would result in 60 percent of sites being lost. This would cause a decline in revenue from snorkeling and catamaran tours in the country (ECLAC 2011).

The vulnerability of the tourism sector in ESC nations poses a threat to the entire economy of these nations. In Saint Lucia alone, the total estimated cost of climate change impacts on tourism—which include reduced visits, land loss, and damage to coral reefs—is estimated to be between $7.9–$12.1 billion by 2050, or 8 to 12 times the nation's 2009 GDP (ECLAC 2011b). The long-term resilience and viability of the tourism industry and the economies of ESC nations depends on tourists trusting the key services, infrastructure, and supply chains associated with tourism.

BIODIVERSITY AND NATURAL RESOURCES

Because the region's main economic activities are tourism, fisheries and agriculture, forests, rivers, reefs, and other terrestrial and marine ecosystems are the foundation of ESC economies and livelihoods, (CDEMA 2014). Not only do ecosystems provide economic opportunities, they also provide ecosystem services such as carbon sequestration. One study found that Caribbean mangroves and coral reefs provide carbon sequestration valued at approximately $6.7 billion and $5.7 billion, respectively (Heck, Narayan, and Beck 2019). Mangroves and coral reefs also provide ecosystem services, such as generating natural resources, nutrient cycling, air and water filtration, and erosion control.

Impacts on ecosystems and biodiversity from seismic and volcanic activity have affected several ecological and fitness traits of key species through the reduction in population sizes and habitat destruction; earthquakes and tsunamis can also affect species and their genetic patterns (Brante, et al. 2019). Impacts from volcanoes include severe ash fall and volcanically generated tsunamis (Hilton et al.

2003). A volcanic eruption on Montserrat in 1995 destroyed the southern 60 percent of the island's hill forests.

Marine ecosystems, including biodiversity of flora and fauna, are impacted by climate and human-induced stressors. High sea surface temperatures and intense storms negatively impact coastal ecosystems, which lead to mass coral bleaching, increased incidences of coral and other invertebrate diseases, and greater physical destruction of the essential habitats of fish and shellfish (Oxenford and Monnereau 2017). These climate hazards exacerbate the ongoing chronic degradation of habitats from other stressors, including pollution, physical destruction from coastal development and marine construction, and chronic over-harvesting. The impacts of these stressors are clear in the changing composition of the foundational reef species, the decline in live coral cover and complexity, and in the loss of mangrove and seagrass habitat. Destruction of coral reefs and removal of mangroves, which help attenuate flood wave energy and reduce erosion, led to an increase in erosion in Grenada (Reguero, Beck, Agostini, Kramer, and Hancock 2018; Ferrario, et al. 2014). Irma, Maria, and other hurricanes and tropical storms also severely damaged or destroyed ecosystems and their associated services (USAID 2018a). For example, seagrass beds and mangrove forests, which so many species rely on, were ripped apart in Dominica during Hurricane Maria in 2017.

SIDS depend highly on the resources provided by oceans and coastal areas to support national growth. The blue economy offers huge potential to Caribbean countries in the form of new sustainable ocean industries, such as sustainable fisheries and aquaculture and marine renewable energy. Opportunities in offshore renewable energy technologies to mitigate carbon emissions include wind, tidal, wave, algal biofuel and thermal and salinity gradient (IPCC 2013). The restoration of vegetated coastal ecosystems such as mangroves, tidal marshes and seagrass beds can provide protection from erosion, and flooding. These opportunities could generate new sources of jobs and diversify the economy, as well as contribute to building climate resilience by reducing the region's dependency on energy imports, address issues of food security, absorb global carbon emissions and provide improved storm protection to coastal communities.

USAID Resilience Capacities

Absorptive resilience capacities – The ability to minimize exposure and sensitivity to shocks and stresses through preventative measures and appropriate coping strategies to avoid permanent, negative impacts.

Adaptive resilience capacities – The ability to make informed choices and changes in livelihood and other strategies in response to longer-term social, economic and environmental change.

Transformative resilience capacities – The governance mechanisms, policies and regulations, cultural and gender norms, community networks, and formal and informal social protection mechanisms that constitute the enabling environment for systemic change.

Climate change also impacts terrestrial ecosystems. Rising sea levels and increased storm intensity is projected to lead to loss of coastlines and beaches in most countries. Increased drought altered rainfall patterns, and rising sea levels will degrade estuaries, inundate lowlands, displace wetlands, and alter tidal patterns in rivers and bays (United States Environmental Protection Agency 2020).

RESILIENCE CAPACITY

The ability of the Caribbean region to effectively address the natural hazards it confronts, and to build resilience over time, requires an interconnected set of capacities at all levels of society—from the household level to communities, and to the national level and regional levels. A

variety of frameworks are applied to understand and assess resilience capacity; this assessment draws on USAID's Climate Risk Management Framework's categorization of institutional, human and community, knowledge and technical, and financial capacities (summarized in the following and Figure 5). These four capacities align to the priority resilience building focal areas defined in CDEMA's Comprehensive Disaster Management Strategy 2014–2024 (CDEMA 2014), which are described in Section 2.2. By evaluating the extent to which communities, countries, and the region have these capacities, one can understand the relative strengths and weaknesses of current resilience and identify priorities for further development.

- *Institutional capacity:* Represents the degree to which governments and other organizations have the authority, processes, and ability to take action to build resilience. This includes clarity of roles and responsibilities related to resilience; institutional coordination; and collaboration among national governments, regional agencies, key stakeholders, and donors.
- *Human and community capacity:* Refers to how well individuals and communities in the country and region prepare for and respond to hazards.
- *Knowledge and technical capacity:* Refers to how well people and governing bodies in each country and across the region collect and use information related to shocks and stressors to assess the impact of these stressors and to design and implement solutions to build resilience.
- *Financial capacity:* Refers to the availability and adequacy of monetary and economic resources in each country and across the region to prepare for and respond to shocks and stressors.

The USAID Resilience Guidance Notes (USAID 2018b) characterize resilience as the result of absorptive, adaptive, and transformative capacities, differentiated by their effectiveness in the face of mild or severe impacts, and the degree to which responses account for longer-term social, economic and environmental change (see text box on page 20). This characterization of resilience capacities focuses first on the ability to cope with immediate negative impacts (absorptive capacity), with governments and civil society ultimately building capacity to pursue strategies for equitable and sustainable resilient communities and economies (adaptive and transformative capacities). It is important to recognize these building blocks of resilience. This assessment considers the essential capacity to withstand and recover from extreme hazards, such as hurricanes. It also considers the degree to which countries and communities are equipped to move beyond recovery, through transformative capacities, to build a more resilient society long-term. Considering the capacity strengths and gaps across the four categories and their components, as outlined in Figure 5, helps to pinpoint areas of investment needed in order to build absorptive, adaptive, and transformative resilience.

INSTITUTIONAL CAPACITY

Regional Institutional Capacity

As described in Section 2.2, the ESC region developed a strong network of regional institutions that provide a strategic framework, resources, and technical support for disaster risk management, climate change analysis, and resilient development. CARICOM leadership directly engages in advancing regional resilience through the Meeting of Heads of Regional Institutions convened by the Secretary General of CARICOM. The Caribbean Pathway for Resilient Development in the Caribbean is the first step in the blueprint for collaborative action.

The framework developed by CDEMA and the planning process underway by CCCCC to update its strategy provide coherent and comprehensive approaches for developing resilience to climate change and multiple hazards over time. These frameworks emphasize the need to consider resilience as integral to all planning and development, across sectors. The Comprehensive Disaster Management Governance

Mechanism led by CDEMA provides a structure for implementing the Comprehensive Disaster Management Strategy, with representation from key sectors and national governments. CDEMA's recent analysis of capacity to fully implement a multi-hazard early warning system (MHEWS) provides important insights on the range of barriers that exist institutionally (CDEMA 2019b; Collymore 2020). Likewise, CIMH developed a strong capacity to coordinate the development of weather and climate information and products, working collaboratively with a network of regional and national organizations.

Other key institutions provide important support to individual sectors. For example, the Caribbean Agricultural Research and Development Institute (CARDI) and Inter-American Institute for Cooperation on Agriculture provide support to technical development in climate-smart agriculture. Caribbean Electric Utility Services Corporation, an association of electric utilities, suppliers, manufacturers, and other stakeholders, helps coordinate industry concerns across the region. CCRIF SPC provides specific financial support for impact-based forecasting, and UWI's Seismic Research Centre operates the largest network of seismographs and other geophysical instruments in the Caribbean and is the source for volcanic information throughout the Eastern Caribbean. The Centre is involved in a regional effort to establish a tsunami warning system for the Caribbean (UWI 2011).

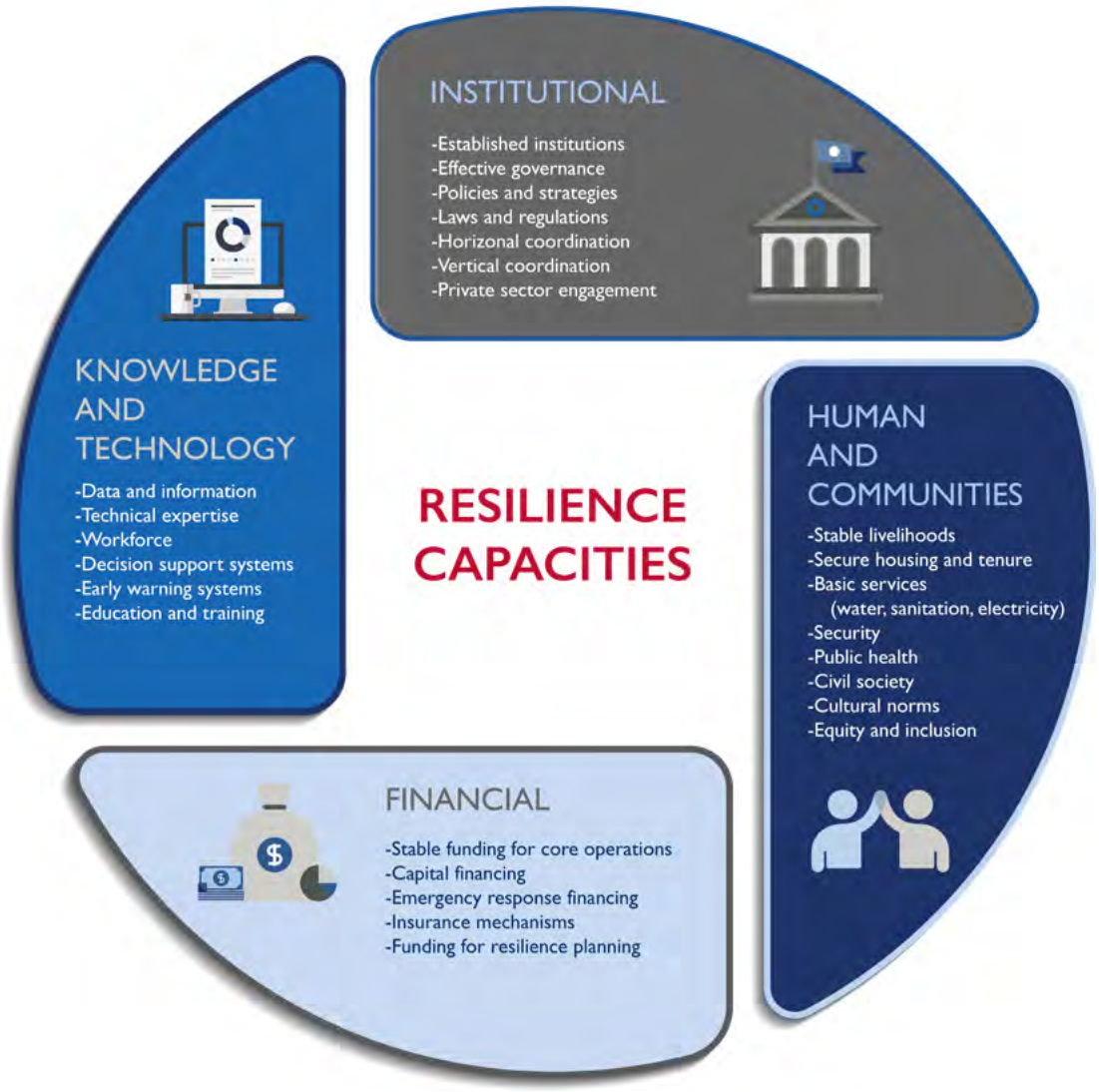

Figure 5. Components of Resilience Capacity adapted from the USAID Climate Risk Management Framework.

The Regional Response Mechanism, developed by CDEMA, is a network of Participating States, national, regional and international disaster stakeholders through which response and relief operations is coordinated when a participating country is impacted by a disaster. The mechanism has made important progress in coordinating member responses to severe events, but improvements in capacity and coordination are still required. Stakeholders raised concerns about gaps in coordination with relief organizations that are not part of the Regional Response Mechanism; these gaps occur at the national, regional, and international levels. The fragmented response to the 2017 Maria and Irma hurricanes across regional institutions, national governments, NGOs, and donors also highlighted the need for improvements to the logistics platform, and for funding mechanisms that are reliable and efficient. Response capacity is particularly stretched during times of multiple severe events (WTO 2019a). In its 2017 rapid assessment following hurricanes Irma and Maria, CDEMA outlined a number of immediate measures as well as longer-term interventions to build disaster response capacity across the region (Collymore et al. 2017). The comprehensive disaster management framework incorporates these measures within a broader framework for integrated resilience.

While key regional institutions generally develop a strong set of policies and plans, several informants noted a considerable gap between the formal policies and procedures and actual implementation on the ground. In some countries this gap reflects the lack of enacted legislation and regulation (see Table 1), which is a foundational step to resilience actions. However, even in countries where legislative authority is in place, a range of barriers often undercut agencies' ability to move from the formal policies to implementation and enforcement.

Several of those consulted identified the need for improved monitoring and evaluation mechanisms, to enable institutions to better define metrics of success, assess progress, and identify measures to address barriers and build resilience through a planned, systematic process. As one major resource, CDEMA developed a number of tools available to help national government agencies assess and prioritize risks, develop policies tailored to country needs and institutional structure, conduct comprehensive disaster management audits, and monitor performance. However, both regional and country-level managers stress that resource constraints—the lack of long-term core funding—hampers their ability to develop and implement a sustained plan to build resilience. They note that international donors typically focus on funding relatively short-term projects with specific requirements; this can undercut institutions' ability to invest strategically in longer-term programs and organizational strengthening.

Interviewees expressed concern about a degree of overlap and inefficiency across institutions; this issue is also documented in the literature (Collymore 2020). The effectiveness of regional institutions relies on horizontal coordination among regional organizations, and on vertical coordination with national government agencies. At the regional level, the roles and responsibilities of institutions are generally defined, and mechanisms are in place for communication and coordination. However, both analyses and consultations point to gaps and overlaps in roles and overly complex institutional processes; stakeholders identify the need to further strengthen and streamline these systems to ensure effective disaster response and sustained progress in building resilience throughout the region. These challenges are not unexpected, given the number and diversity of institutions involved and the complexity of integrating the multiple components related to resilience. The CDEMA MHEWS report finds that "complex multi-level governance arrangements including limited coordination of the many actors involved and the insufficiently defined roles and responsibilities of actors beyond the disaster risk reduction lead agencies" are barriers that need to be addressed (Collymore 2020).

National Institutional Capacity

The impacts of natural hazards are directly felt by individual countries and communities; the responsibility to protect public safety and maintain essential services necessarily falls to national governments and their

local partners. However, the capacity of national governments to lead their country's resilience activities and to work with regional institutions varies across the member nations of the ESC. During the 2017 hurricanes, for example, communication systems broke down between National Meteorological and Hydrological Services and national disaster offices, pointing to the need for improved standard operating procedures between regional and national organizations (Collymore 2020). Coordination is complicated by the varying capacities of individual countries in the region. Key informants report that some national agencies assume considerable responsibility, while others are stretched to implement the policies and procedures set up at the regional level. A key role of the regional institutions is to provide technical training and guidance to national agencies. As the capacity of national governments increases, the effectiveness of vertical coordination can likewise be expected to strengthen.

Legal Frameworks Affecting National Resilience

The degree to which countries establish strong disaster risk management and climate change policies, strategies, and legislation, is shown in Table 1. National disaster risk management laws have long been the main legislation regarding resilience—some have been in place for several decades and have not been updated. As such, the existing disaster management legislation in most countries generally take a reactive approach—focused on response and recovery—rather than a proactive comprehensive disaster management approach. The disaster response and recovery portions within existing legislation also have gaps; these include the lack of clear mechanisms for receipt of international assistance following disasters, lack of provisions on remedial measures following disasters, and lack of specificity in regulations for emergency operation centers and shelters.

The blueprint for integration of comprehensive disaster management at the national level involves evolution across the following components: a national comprehensive disaster management policy framework; a comprehensive disaster management strategy to implement the policy; and lastly, legislation to codify comprehensive disaster management into law (CDEMA 2019b). To support uptake into national-level legislation, CDEMA proposed a model comprehensive disaster management legislation and regulations for countries to adopt (CDEMA 2013a). CDEMA also developed policy guidelines for integration of comprehensive disaster management into national sectoral policies for agriculture and tourism (Smith and Carby 2018a, b). Furthermore, Country Work Programs serve as an important tool to guide the national-level implementation of the Comprehensive Disaster Management Strategy and Sendai Framework. To date Barbados, Saint Lucia, Antigua and Barbuda, and Guyana have developed Country Work Programs (CDEMA 2019a). Barbados is furthest along in integrating comprehensive disaster management into national policies, strategies, and legislation.

Meanwhile, most countries are still in the initial phase of a draft comprehensive disaster management policy framework and not yet advanced toward development of legislation, as indicated in Table 1. Consultations suggested some countries have pending policies that are not advancing due to competing priorities and the lack of strong political leadership or champions to push forward proposed policies for adoption into law. In countries with comprehensive disaster management policies in place, many still struggle to implement and enforce those policies due to technical, staffing, and financial deficits. Exacerbating this challenge, the cycle of recurring disaster events forces institutions to focus resources on disaster response and recovery (absorptive resilience), leaving less capacity to plan and implement longer-term, more transformative strategies.

Though comprehensive disaster management policies remain a challenge, with climate change exacerbating risks in ESC, countries have developed climate change national policies, though development of national adaptation plans to implement the policies varies across countries. These recently developed climate change adaptation strategies and policies incorporate sectoral approaches.

For example, Saint Lucia's National Adaptation Plan 2018–2028 includes sectoral measures, and the country also developed three Sectoral Adaptation Strategies and Action Plans for Water, Agriculture, and Fisheries in April 2018 (Weeks and Bello 2019). Furthermore, with global coordination on climate change under the UNFCCC and the Paris Agreement, countries developed National Communications and Nationally Determined Contributions (NDCs) with adaptation targets, which serve as standardized initial entry points for development partners to engage with countries on climate adaptation. Despite the existence of several climate change policies and strategies, there exists a gap in legislation to define agencies' roles in resilience to long-term climate changes. For example, Saint Lucia's Disaster Management Act established the National Emergency Management Organization (NEMO), but the country lacks legislation to govern the mandate of the Department for Environmental Management whose work ranges from climate change adaptation to chemicals management.

The development of a sustainable blue economy will also require some changes to governance and policies to consider environmental and economic factors. Existing governance structures would likely require new legislation, rules and the strengthening of institutions (Roberts 2016). In addition, converting new opportunities into productive sectors would require investment into research and development, the building of technical capacity and creating an environment to interest and maintain outside investment. Thus, the blue economy has an important role to play in building resilience to climate change in coastal populations in SIDS to adapt its adverse impacts.

Hawksbill Turtle and Diver

Table 1. Disaster risk management legislation and policies (Evanson 2014; O'Marde 2017; Thomas-Louisy 2014; Charles 2014; Government of Trinidad and Tobago 2014; Velasco 2014) and climate change adaptation plans, strategies, and policies (NDC Partnership 2020).

Country	Primary Disaster Risk Management Legislation	Comprehensive Disaster Management Policy or Legislation	Climate Change National Policy	National Adaptation Plan	NDC	UNFCCC National Communications	Resilience-related Strategic and Sector Action Plans
Antigua and Barbuda	Disaster Management Act (2002)	Draft national comprehensive disaster management policy under development	None Climate change addressed in the Environment Protection and Management Act (2015)	Under development	Intended Nationally Determined Contribution (INDC) (2015) NDC (2016)	National Communications III (2015)	• Antigua and Barbuda's 2015–2020 National Action Plan: Combatting Desertification, Land Degradation and Drought • National Biodiversity Strategy and Action Plan 2014–2020 • Sustainable Energy Action Plan of Antigua and Barbuda 2010–2030 • National Adaptation Strategy and Action Plan to Address Climate Change in the Water Sector (2014)
Barbados	Emergency Management Act (2007)	Integration of comprehensive disaster management into policies, strategies, and legislation since 2003	Barbados National Climate Change Policy (2012)	None	INDC (2015) NDC (2016)	National Communications II (2018)	• Responding to Emergencies: The Barbados Plan 2018 • National Strategic Plan of Barbados 2005–2025 • A National Biodiversity Strategy and Action Plan for Barbados (2002)
Grenada	National Disaster (Emergency Powers) Act (1984)	Draft National Disaster Management Plan (revised 2012) incorporates concept of comprehensive disaster management	National Climate Change Policy (2017–2021)	National Adaptation Plan (2017–2021)	INDC (2015) NDC (2016)	National Communications II (2019)	• Grenada: National Disaster Plan 2005 • Grenada Drought Management Plan draft (2019)

Country	Primary Disaster Risk Management Legislation	Comprehensive Disaster Management Policy or Legislation	Climate Change National Policy	National Adaptation Plan	NDC	UNFCCC National Communications	Resilience-related Strategic and Sector Action Plans
Guyana	National Disaster Preparedness and Response Plan (1982)	Draft disaster risk management Policy (2013) and Bill (2013) incorporates concept of comprehensive disaster management	National Climate Change Policy and Action Plan (2020–2030)	National Adaptation Plan for the Co-operative Republic of Guyana, 2019	INDC (2015) NDC (2016)	National Communications II (2012) National Communications III under development	• National Multi-hazard Preparedness and Response Plan (2013) • National Drought Mitigation and Adaptation Plan • National Flood Preparedness and Response Plan of 2010, revised in 2012 • Guyana: Climate resilience strategy and action plan 2015 • National Biodiversity Action Plan 2007–2011 • Green State Development Strategy: Vision 2040 • National Strategy for Agriculture in Guyana 2013ç2020 • Disaster risk management plans for five municipalities
Saint Lucia	Disaster Management Act of Saint Lucia (2006)	Comprehensive Disaster Management Strategy and Programme Framework (draft 2007, approved 2009). Disaster Management Policy Framework (2009) incorporates concept of comprehensive disaster management	National Climate Change Policy and Adaptation Plan (2015)	National Adaptation Plan (2018–2028)	INDC (2015) NDC (2016)	National Communications III (2017)	• Sectoral Adaptation Strategy and Action Plans (2018–2028) for: Agriculture, Fisheries, Water • Resilient Ecosystems Adaptation Strategy 2019
Trinidad and Tobago	Disaster Measures Act (1978)	Draft Comprehensive Disaster Management Policy Framework (2007)	National Climate Change Policy (2011)	None	NDC (2018) only includes mitigation measures	National Communications II (2013)	• Biodiversity Strategy and Action Plan 2001 • National Biodiversity Strategy and Action Plan • National Integrated Coastal Zone Management Policy Framework • National Integrated Water Resources Management Policy 2017 • Vision 2030 National Spatial Development Strategy 2016–2030

HUMAN AND COMMUNITY CAPACITY

The capacity of communities to prepare for, respond to, and recover from impacts varies considerably across nations in the region and within each country. Higher income nations generally have stronger resilience at the community level because they have basic infrastructure and services, housing, security, and communications in place. Throughout the region, however, poor communities have limited capacity to withstand impacts from natural hazards. Lower-income households have little or no savings to draw on when their homes or businesses are damaged or destroyed by storms or earthquakes, or their crops are devastated by drought. Loss of livelihoods dependent on a tourism industry that rapidly declined due to COVID-19 left many wage earners with no income, even as an active hurricane season ramped up in 2020. Climate change will exacerbate these impacts on livelihoods, increasing the number of at-risk households and further reducing community resilience.

As poor individuals migrate to urban areas for jobs, informal settlements expand in high-risk areas, including low-elevation coastal areas subject to repeated flooding. Living in substandard housing without basic water and sanitation, these families face chronic disease and food insecurity, and are on the front lines during severe hurricane and flooding events. Within poor households, women, children and youth, as well as the elderly and disabled, have lower capacity to withstand natural hazards due to their marginalized status. Further, the destruction and loss of coastal communities by severe events results in displacement and new forms of migration, as those impacted leave in search of greater physical and economic security. This disruption of the social fabric of local communities may profoundly impact efforts to build resilience and bears further examination.

Local perceptions about the risks of natural hazards are often a barrier, as the frequency of disasters combined with limited options to respond fosters a sense of fatalism within disadvantaged communities. Consultations highlighted the importance of working with communities to shift the cultural norms and attitudes that discourage people from taking action to reduce their risks. These attitudes affect the willingness of communities to consider ways to improve resilience. When recovering from disasters, for example, building codes and land use regulations are frequently ignored, and the enforcement capacity of local governments is typically weak. This creates an environment in which local actors rebuild in high-risk locations or with substandard materials and construction, maintaining or even increasing their future risks.

Support to local communities regarding disaster response includes early warning systems, informal networks, and government and non-profit organizations that work to build awareness, develop neighborhood response networks, and provide disaster relief. The development of Community Emergency Response Teams is an example of local mobilization of frontline responders that helps to empower local residents. The Inter-American Foundation is a significant actor working at the grassroots level with local community groups. USAID partnered with the foundation to work with communities around a broad theme of long-term resilience, addressing natural hazards as well as community infrastructure and economic development.

Stakeholders noted the general absence of risk management plans at the local level and the limited consideration given to the integration of historical and indigenous knowledge in such plans in the areas where they may exist. Longer-term programs to help youth and adults build skills and increase livelihoods exist throughout the region. However, these programs are not available to all communities and many efforts are underfunded and understaffed. Reliance on external funding limits the ability to achieve long-term, systemic change. Ultimately, building sustainable resilience of communities is tied to the ability of households to have secure livelihoods, health services, and education. The development of strong, sustainable economies is integral to the resilience of ESC citizens.

KNOWLEDGE AND TECHNICAL CAPACITY

The technical capacity of the region and some countries developed significantly under the leadership of CARICOM regional institutions and their national partners, and with the support of several international and regional financial partners. CDEMA, CIMH, CCCCC, UWI, CCRIF SPC, University of Guyana and other regional institutions made substantial progress in building technical capacity and developing a coherent long-range vision for further progress.

The UWI body of research, tools, and programs support disaster risk management, climate change adaptation, and resilience going back over 70 years. Its Climate Studies Modelling Group is globally recognized for its work in climate change, for its championing of 1.5 to Stay Alive, and for pushing for the inclusion of the chapter on SIDS in the IPCC Reports. It's suite of models support evidence-based decision-making in physical, fiscal, and social policy and programming. Other UWI entities include the Seismic Research Centre, the Disaster Risk Reduction Centre, the Centre for Environmental Management, and the Centre for Environment and Resources Management.

CIMH has ongoing efforts to improve forecasting to allow countries to respond more effectively and take appropriate actions. CIMH is working to build capacity to collect and apply observed weather data and forecasts in countries throughout the region, and provide equipment, communications systems, and training to national staff. CIMH supports the hurricane forecasting capacity through a network of Doppler radars in Barbados, Belize, Cayman Islands, Guyana, Trinidad, French Guyana, Martinique, Guadeloupe, Dominican Republic and Jamaica (CDEMA 2019b). CCRIF SPC manages a training center and provides internships and scholarships to expand capacity.

The meteorology and climatology community increasingly focuses on producing early warning information products to support specific decision makers. The Consortium of Regional Sectoral EWISACTs Coordination Partners draws on CIMH's suite of technical climate products provides "user-specific and actionable climate information products" to support decision-making in a variety of sectors, including agriculture, public health, and tourism. Support for agriculture developed considerably through collaboration with World Meteorological Organization (WMO), CARDI, and national meteorology departments (Mahon, et al. 2018). The Institute, with support from USAID and other donors, worked to integrate natural sciences methodologies with social science data and methodologies to support a more holistic approach to understanding risks (Mahon, et al. 2018).

Substantial progress was made in weather and hazard observations, real-time warning, forecasting, and climate projections. And much work was accomplished to define the needs of national and private sector decision makers and develop information products that support effective near-term decisions and longer-range plans. The Climate Modelers' Consortium helped to ensure decision makers have relevant climate science information that is up to date and tailored to small island countries. These efforts need to be continued. In consultations, stakeholders highlighted the need for improved forecasting capacity, including expanded computational capacity and trained personnel. Studies identify a need to further expand the range of sectors supported by CIMH and its partners (Mahon, et al. 2018). Currently, countries continue to rely on storm tracking based in Miami; informants called for expanded services available in the region. In addition, a regional multi-hazard warning system was identified as a key gap.

The Sendai Framework urges a paradigm shift in the way risk information is developed, assessed and utilized to support MHEWSs (CDEMA 2018a). Early warning systems in the ESC states are comprised of multiple independent sectors issuing alerts and warnings. For example, single hazard early warnings can be issued in different formats by national disaster offices, Ministries of Health and Environment, Agriculture, Lands and Fisheries, and specialty institutes (e.g., Montserrat Volcano Observatory,

UWI Seismic Centre, Caribbean Tsunami Warning Program, Pacific Tsunami Center). The lack of a centralized mechanism for the communication of alerts and early warnings presents a challenge to addressing multi-hazard events. In addition, many countries indicated that despite advances, there is still a need to comprehensively improve early warning systems particularly for storms, floods, tsunamis, and volcanic events. Investments in MHEWS capacity at the national level are being made in six Caribbean countries, including Antigua and Barbuda and Saint Lucia, where a gap analysis of the MHEWS system was conducted and MHEWS investment roadmaps were developed.

Disaster risk management agencies need to move from a single hazard approach to an integrated, multi-hazard forecasting capacity. The ability to implement a multi-hazard approach would help disaster risk management and sectoral agencies to better prepare for and respond to the full range of potential hazards and manage interacting hazard events more effectively. Finally, residents need clearer information about forecast events and the impacts these events have on their communities. Stakeholders reported poor that communication undercuts community-level preparedness. Scientific forecasts need to be translated into relevant, usable information that resonates with and empowers communities.

In addition, technical capacity and tools that help to understand the cascading repercussions of single and multi-hazard events on interconnected and interdependent infrastructure services are lacking. To that end, Saint Lucia established the National Integrated Planning and Programme Unit. Notably, the unit was placed in the department of finance allowing for better overall alignment of sector strategies in the context of the country's overall financial planning, helping to move beyond a siloed planning process. The National Integrated Planning and Programme Unit takes a multi-hazard, multi-sectoral approach to assessing infrastructure resilience and investment needs, including collecting and analyzing data from a number of sectors: electricity, water, wastewater, solid waste. This integrated assessment helps inform decisions about new investments, policies, or projects by identifying the most effective or urgent programs to increase resilience and selecting investment priorities across different sectors.

Institutional Knowledge and Availability of Trained Personnel

Thanks to the CARICOM network of institutions, including UWI, technical skills are expanding in the areas of hazard forecasting, climate sciences, disaster risk management, geospatial analysis, economic development, public health, planning, agriculture, and other disciplines. However, the demand for trained personnel far exceeds the number of professionals being produced in the region. While educational standards throughout the region are high, the small population of most countries limits the number of trained professionals. Those that are available are in high demand and often take positions in the private sector rather than in government, academia, or the non-profit sector. Institutions therefore report a struggle to attract and retain competent personnel. Compounding this problem are the limited budgets of most national government agencies; national ministries are unable to create the positions they need. In addition, national disaster risk management agencies—in contrast to line ministries in the national government—operate with contracted staff rather than permanent civil service personnel. This means staff turnover is high, making it more difficult to build sustainable capacity and institutional knowledge.

UWI is spearheading efforts to expand the number of trained professionals. It launched a Graduate Certificate in Disaster Risk Management and Resilience in September 2020, and many special courses are rolled out in collaboration with development partners. This will be coordinated within the umbrella of a UWI-led collaboration of higher education institutions for Climate Smart and Resilient Development.

Applied Knowledge

Stakeholders highlighted gaps between the generation of information by regional institutions and universities and the use of this knowledge by practitioners, and stressed the need for expanded outreach, training, and capacity building at the national and community levels. Knowledge within the sectors, combined with strong extension and community education programming, is required to help integrate hazard and climate information into practice. For example, farmers need capacity in climate-smart and advanced agriculture techniques so they can use available information to manage climate change-driven shifts in seasonality and increasing drought conditions. Increased expertise in agriculture across the region would help invigorate the agriculture sector to attract youth to the sector and support increased food security. Similarly, increased knowledge of climate change adaptation and planning as it applies to urban development would help communities develop in more climate-smart and resilient ways. Work of this kind is already underway through UWI research and partnerships with communities, government, and the private sector. The Guyana Civil Defense Commission (CDC) partners with the University of Guyana to provide a one-year certificate program in Introduction to Disaster Risk Management to volunteers in the Volunteer Emergency Response Team program. But these programs need support in scaling and enhancement.

One example of successful integration of comprehensive disaster management into sectoral decisions is CDEMA's Model Safe School Programme in the Caribbean. The program was designed to enhance the capacity of Antigua and Barbuda, Dominica, St. Kitts and Nevis and Saint Lucia to incorporate and mainstream comprehensive risk and disaster management considerations in education sector policies, planning, and operations. The initiative included hazard risk assessment for schools, and development of tools, training, and support for policy development to improve the safety of students and reduce risks to school facilities and personnel.

There are multiple examples of technical knowledge applied to enhance resilience capacities across other sectors. In the agriculture sector, the region has been using drip irrigation for decades. Additional resilience measures are being implemented to address water scarcity including climate-smart agriculture, educating farmers to measure water availability in the soil, rainwater catchment systems and solar pumps, use of drought-tolerant crops, and hydroponics. In the water sector, countries have resilience technologies in place to address water scarcity. Barbados currently relies on saltwater desalinization plants to provide fresh water and is implementing water management measures for resilience such as enhancing infiltration, increasing water capacity through rainwater harvesting and water storage, and reducing non-revenue water. Antigua and Barbuda also use desalinization to meet their water needs.

FINANCIAL CAPACITY

Economic Structure and Debt Burden

The financial strength of ESC countries is directly affected by the disasters they endure. According to the Economic Commission for Latin America and the Caribbean (ECLAC), annual losses from catastrophic climate events in the Caribbean are estimated at $3 billion, and in 2018, the average Caribbean debt was 70.5 percent of GDP (International Institute for Sustainable Development (IISD) 2019). The need to borrow to rebuild and restore services creates an ongoing economic burden. Further, the underlying structure of the economy increases the exposure of nations to market fluctuations; national revenues are overly dependent on international investments, tourism, and export revenues. This exacerbates the economic fragility of ESC nations. Most countries rely heavily on ocean resources for economic development; these resources are also under stress due to climate change and degradation of the marine environment. There is a need to strengthen and diversify revenue streams, invest in emerging markets, and increase self-sufficiency.

The enormous debt carried by Caribbean nations—among the highest in the world—constrains the ability of countries to invest in the core development activities that build community resilience, and to

move from absorptive to transformative resilience measures. For example, in the case of Dominica, the need to respond to the immediate impacts of Tropical Storm Erika and Hurricane Maria reversed the progress it had made in debt management and raised Dominica's trade deficit by almost 150 percent (WTO 2019a). The collapse of tourism due to COVID-19 is of major concern to SIDS in particular and is deeply exacerbating the debt burden of most.

In addition, some countries in the region (e.g., Barbados) are no longer eligible for concessionary loans through global financial institutions due to their higher national economic status, despite their continuing needs (Robinson 2018). Further, no ESC countries qualify as Least Developed Countries—a designation required for much international aid. ESC countries' inability to access lower-cost financing further strains resilience investments by these nations. ESC countries (with the exception of The Bahamas) are already rated below investment grade by Moody's, making it difficult for countries to maintain and attract new investments. Prospects that island states' sovereign ratings might be downgraded over time due to climate risks and impacts put these countries in a type of financial trap, leading to increasing vulnerabilities to climate change, inability to manage national finances, and dependence on foreign aid (Fuller et al. 2018). Strategies to help address the barriers to resilience caused by debt burden have been a matter of concern for decades, including proposals for debt swap programs for disaster risk management. Recently, ECLAC proposed a Debt for Climate Adaptation Swap initiative to help the region invest in resilience measures to specifically address risks exacerbated by climate change risk (IISD 2019). There is a fundamental need to revamp the architecture of risk financing to enable debt-burdened countries at high risk to escape the cycle of extreme debt.

Disaster Response and Recovery Financing

Governments are deploying disaster risk finance instruments, including emergency funds, insurance instruments, and contingency lines of credit. Countries across the region need quick access to funding to support disaster response, recovery, and reconstruction. Parametric insurance instruments provide critical and timely resources to countries impacted by severe events, better enabling recovery in the aftermath of devastating tropical storms, hurricanes, and earthquakes. An assessment conducted by the World Bank and Department for International Development (DFID) shows the degree of coverage of these instruments varies across the region, with most countries still undersupported (Banister 2020). Figure 6 from the study and illustrates the range of mechanisms currently in use in nine nations throughout the Caribbean.

CCRIF SPC[1] is of emerging importance in the region. Eight countries received payouts of more than $50 million from the CCRIF SPC (WTO 2019a). At this time, CCRIF SPC offers parametric insurance policies for tropical cyclones, earthquakes, excess rainfall, and the fisheries sector. CCRIF SPC is steadily expanding its coverage to new sectors and increasing the number of participating countries, but the needs continue to outstrip its capacity at this stage.

National governments highlighted the insufficiency of available financing for response actions due to limited budgetary allocations as a major impediment. Several individual countries are establishing reserve funds that can build over time (in the absence of costly disasters), to be accessed following a disaster. Dominica, Grenada, Guyana, Saint Lucia, and Saint Vincent and the Grenadines each set up a government reserve. Most of these funds are in a nascent stage and still undercapitalized but represent a positive step. Stakeholders stress the importance of senior level buy-in to ensure governments continue to allocate resources to these reserves, and that policies are developed to manage these funds effectively.

1 CCRIF members include 19 Caribbean governments—Anguilla, Antigua and Barbuda, The Bahamas, Barbados, Belize, Bermuda, British Virgin Islands, Cayman Islands, Dominica, Grenada, Haiti, Jamaica, Montserrat, St. Kitts and Nevis, Saint Lucia, Sint Maarten, Saint Vincent and the Grenadines, Trinidad and Tobago, Turks and Caicos Islands and three Central American governments—Guatemala, Nicaragua, Panama.

In many countries, disaster risk reduction still depends heavily on external sources of finance, though progress is demonstrated. Challenges include competing priorities and lack of legally binding commitments. Meeting these challenges will require an understanding of the dynamics of the budget process and the linkage between plans and budgets. Fiscal frant mechanisms provide potential solutions for local disaster risk reduction financing. Stakeholders noted the need for better accounting and transparency of disaster risk management expenditures, to better understand how much and toward what end funds are allocated. Extreme events have immediate and longer-term impacts on national economies. For example, in the aftermath of the 2017 hurricanes the IMF projected economic output in Dominica would drop by 14 percent in 2018 and take around five years to recover to pre-hurricane levels (WTO 2019a). Following hurricane events, for example, trade systems and essential infrastructure for goods management—such as ports, warehouses, and transport networks—are disrupted. These impacts extend for months as infrastructure is rebuilt and operational systems reestablished. While advances have been made in developing financial instruments to address these challenges, there remains a critical lack in adequate financial reserves and sufficient credit and insurance instruments. This financial exposure undercuts the capacity of ESC nations to provide critical relief post-disaster and to recover from destruction and service disruptions, particularly when multiple events occur in quick succession.

Institutional Financing for Long-term Resilience

The limited resources and heavy debt burden of ESC nations directly impacts the capacity of regional organizations as well. CDEMA and other institutions are funded through pledges from participating countries that are sometimes challenged to fulfill their commitments. As a result, regional institutions find themselves overly dependent on international donors to support their programs and operations. Donor funds are instrumental, but stakeholders report that donor priorities and requirements—as well

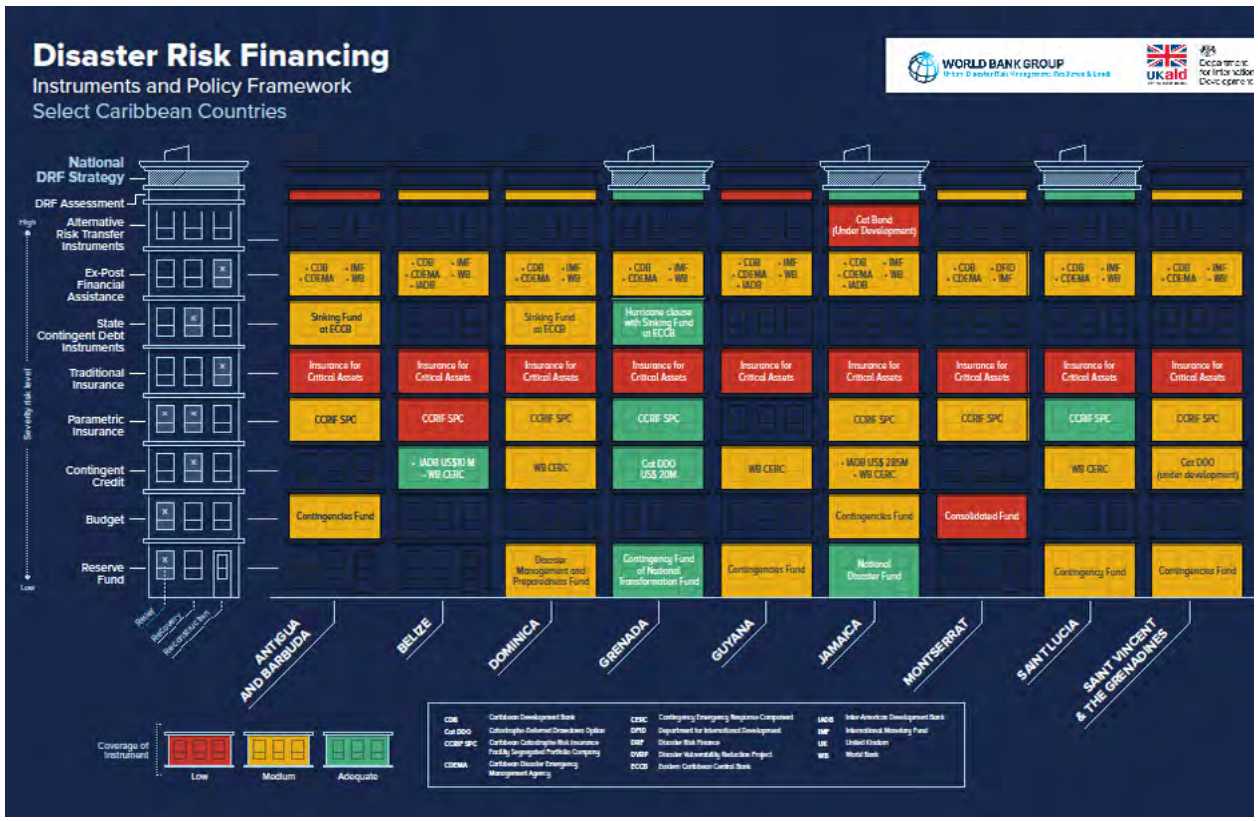

Figure 6. Disaster Risk Financing Instruments in Select Caribbean Countries (source: DFID personal correspondence)

as the short-term nature of most funding programs—often drive fragmented project activities rather than supporting sustained strategic investments. As a result, regional institutions' capacity fluctuates based both on the ability of member nations to fulfill their commitments and on the availability of international donor funding. This financing structure makes it more difficult for regional organizations to maintain a stable, long-term strategy and build institutional knowledge and technical capacity.

Donors recognize and work to address the problems created by funding programs and requirements that are not aligned across financial institutions. In recent years, mechanisms such as the Caribbean Resilience Fund and the Multi-Donor Trust Fund have been established to help coordinate and channel donor investments to support long-term strategic goals of the region.

Financial Management

A further challenge to regional institutions is the degree to which effective systems are in place to manage funds. A Canada-Caribbean Resilience Facility report found that public financial management systems across the region "are not designed with the strategic intent to optimize disaster response. Public financial management is not generally seen as an essential component of disaster risk management, especially as it relates to carrying out procurement and audit operations for disaster response operations. The lack of adequate procurement planning and limited use of strategies for optimizing emergency procurement could result in inefficient use of public funds and constrained response capacity" (World Bank 2020,12).

OVERALL RISK

In ESC countries, natural hazards and stressors rarely occur alone or lead to single impacts–it is a multi-hazard environment. For example, loss of vegetation due to drought, followed by intense rain events leads to landslides; the impacts of disease, oil spills, or other problems triggered by human activity can exacerbate the impacts of natural hazards. In addition, due to limited space and resources, island states in particular lack the capacity to absorb the impacts that occur. Due to their small size, resource interdependencies are inherent in island geographies, making them highly susceptible to cascading and compounding repercussions. And across both mainland and island countries, consequences from successive hazards are difficult to overcome, straining response and recovery efforts and draining financial resources targeted towards rebuilding. Impacts from these multiple natural hazards are realized across a range of sectors that ultimately affect the livelihoods, economy, and development of the ESC region.

To cope with impacts, stakeholders within ESC developed capacities to some degree which can broadly be categorized into institutional, human and community, knowledge and technical, and financial capacities. The strong network of regional institutions (e.g., CDEMA, CCCCC, CIMH, UWI, CCRIF SPC, others) provides considerable support for resilience across the region, but improvements in capacity and coordination are still needed. Across ESC countries, national-level institutional capacity, capacity of communities, and technical and financial capacities vary considerably. These variations in national- and community-level capacities contribute to differences in risks across countries that warrant tailoring of regional-level resilience programming to meet the specific needs and capacities of each country. Current resilience gaps, programmatic opportunities, and recommendations to build resilience and address risks in a multi-hazard environment, are outlined in Section 4.

3.2 CURRENT STATUS OF THE REGION'S RESILIENCE PROGRAMMING

USAID/ESC's most recent resilience program is the Caribbean Climate Resilience Initiative, launched in August 2020 in partnership with CDEMA. The goal of the program is to provide support to CDEMA, and in turn member countries, to integrate and institutionalize comprehensive disaster management.

Numerous development partners also dedicate significant programming to support regional entities and national governments on resilience. The Eastern Caribbean Development Partners Group (ECDPG) was established to provide a formalized forum for coordination among donors and development partners. ECDPG mapped programs and projects underway in the region to four priority areas within the 2017–2021 UN Multi-Country Sustainable Development Framework, which was developed to align with Caribbean nations' priorities (Barraza 2020). This reflected projects being implemented at the time of the data collection for the 2020 report, as well as the projects on the pipeline that were due to be implemented in 2020. Among the four priority areas for programming, sustainability and resilience has received the largest contributions by an order of magnitude:

- A Sustainable and Resilient Caribbean: $1,807 million
- An Inclusive, Equitable, and Prosperous Caribbean: $737 million
- A Safe, Cohesive, and Just Caribbean: $153 million
- A Healthy Caribbean: $80 million

Within the sustainability and resilience priority area, the United Kingdom's DFID[2] is by far been the largest donor in the region ($508 M, almost 30 percent of the total contributions within this priority area). Contributions towards this priority area also come from (in order of financial contributions): World Bank, Inter-American Development Bank (IDB), European Investment Bank, European Union, Canada, USAID, UN System, France, Japan, and New Zealand.

However, it is important to note some gaps in the ECDPG mapping exercise. It did not include programs funded through the Green Climate Fund (GCF) and several other bilateral donors working in the region (e.g., German Agency for International Cooperation (GIZ)) and did not include USAID/ESC's recently launched Caribbean Climate Resilience Initiative.

The programmatic areas covered by the programs underway according to the ECDPG mapping exercise are summarized in Table 2.[3] The majority of these programs focus explicitly on resilience building, climate change adaptation, and disaster risk management (as categorized by ECDPG). The largest programmatic area is 'resilience building' which "aims to enhance long-term resilience and adaptation capacity." The programs are implemented by a range of regional entities (e.g., CDEMA, CCCCC), finance institutions (e.g., CDB), national ministries, academic institutions, non-profits, and UN agencies (e.g., UNDP, FAO).

2 On September 2nd, 2020, the DFID and the Foreign and Commonwealth Office became the Foreign, Commonwealth, and Development Office of the UK Government.

3 The assessment team recognizes areas of overlap in the programmatic focus areas and lack of defined parameters for how a program is categorized into these areas but has kept the same programmatic focus area categories from Barraza 2020 for traceability.

Table 2. Programmatic focus of development partners and geographies the programs cover. The total financial contributions are for the entire Caribbean region (i.e., are not specific to the geographies of focus for USAID). Synthesized from Barraza 2020.

Programmatic Focus	Total	Region	Antigua & Barbuda	Guyana	Trinidad & Tobago	Saint Lucia	Grenada	Barbados
Resilience building	$535,528,245	x	x	x	x	x	x	x
Sustainable Energy	$412,070,445	x	x	x	x	x	x	x
Climate change adaptation and mitigation	$334,433,257	x	x	x	x	x	x	x
Disaster risk management	$201,226,608	x	x	x	x	x	x	x
Rehabilitation and Reconstruction	$156,820,405		x			x		
Natural Resources Management	$88,071,879	x	x	x	x	x	x	x
Agriculture	$29,724,000	x	x			x		x
Access to water	$27,538,200					x		
Support to institutions	$13,405,806	x	x	x	x	x	x	x

There are 139 programs underway under the resilience priority area. The largest program is DFID's UK Caribbean Infrastructure Partnership Fund, valued at $423 million—an order of magnitude greater than all other individual programs within this priority area in the region. Part of the impetus for the project was the clear need for a mechanism to quickly fund reconstruction projects following the succession of disasters in 2017. This program, implemented through CDB, is designed to create critical economic infrastructure (e.g., ports, water infrastructure, sea defenses) to support both increased productivity and resilience to natural hazards and climate change.

The ECDPG mapping exercise illustrated several gaps in resilience programming, and a need for much stronger alignment of investments. With many development partners working extensively on resilience in the region, there is a need for increased coordination and collaboration among partners to ensure the priorities and strengths of each donor contribute to a coherent strategy. ECDPG serves as a formal forum for coordination, though the consistency of regular meetings several times a year has declined due to lack of funding. A key gap is a lack of a repository of lessons learned and best practices from recent and ongoing existing projects across the region, which could help facilitate coordination among stakeholders (Barraza 2020). This compilation would provide the information and knowledge necessary for development partners to collaborate more strategically. This could include funding a joint evaluation process, combined with longitudinal research, to better understand the relative effectiveness of different interventions, design and prioritize strategies, and develop a common understanding of the roles and contributions of each development partner.

The ECDPG analysis also demonstrates that while resilience needs are cross-cutting, programming is largely siloed with limited sectoral integration. As shown in Table 2, programming for resilience in natural resources, agriculture, and water access—sectors that will face increasingly severe impacts under a changing climate—receives relatively low financial resources and are limited in geographic coverage. In addition, ECDPG identified the need to scale up blue economy projects, which have the potential to enhance resilience of coastal resources while supporting economic growth and food security.

However, as mentioned, several programs supporting sectoral integration are not captured in the ECDPG mapping. For example, while Table 2 indicates programming for resilience in water access is occurring only in Saint Lucia, sizable water resilience programs are also underway in Grenada and Barbados, supported by donors not included in the analysis.

The ECDPG mapping found programming is primarily geared towards enhancing technical and financial capacities for resilience, with relatively limited programming ($13 million) explicitly geared toward building institutional capacity (Barraza 2020). However, the few programs that do focus on strengthening institutions address important needs, including building capacity for coordination between regional and national institutions and building capacity to mainstream gender into comprehensive disaster management.

International climate finance is a complex funding landscape, and often challenging for countries to access. Regional entities, including CDEMA, OECS, and the Caribbean Natural Resources Institute, helped to address this complexity by submitting proposals for GCF funding to support member countries. ESC countries have limited direct access to GCF funding (GCF n.d.). CCCCC, in its capacity as a GCF Regional Implementing Entity, is supporting countries to apply for direct access to GCF funding. The Water Sector Resilience Nexus for Sustainability in Barbados is CCCCC's first country project through GCF and is designed to strengthen resilience on the water sector. But barriers remain. Key challenges observed through CCCCC's engagement with countries include the limited workforce and technical capacity within national ministries; countries do not have the capacity to implement readiness activities to access GCF funding (Acclimatise 2020). Recognizing the unique needs in the Caribbean, GCF held Structured Dialogues to support readiness as a critical step to improve climate change risk management and resilience in the region (GCF 2018b).

4. RESILIENCE AREAS FOR POSSIBLE PROGRAMMING

This section provides recommendations for interventions to support inclusive, resilient, and sustainable development objectives in the ESC region, based on gaps and related opportunities identified in this assessment. The recommendations align with USAID ESC's regional programming development objectives and sectors, and account for ongoing regional, national, and donor engagement. The section begins with a set of overarching principles for investing, before diving into gaps, opportunities, and recommendations.

4.1 GUIDING PRINCIPLES FOR INVESTING

Several high-level principles should guide the integration of resilience into USAID/ESC programming.

The first principle is to **take both a systems- and sector-level approach**. Integration requires two actions: identifying and supporting the specific needs of individual sectors to build resilience through tailored decision support and resources, and recognizing that sectors do not operate in isolation, and natural hazards impact multiple sectors simultaneously and can lead to cascading impacts across sectors. That is why in addition to identifying and supporting the specific needs of individual sectors, USAID should also employ a systems-level approach. Based on the identified gaps, a mix of systems- and sector-level recommendations were identified.

A second principle is to **focus on core capabilities and sustainable programming that drive transformative changes.** While support for absorptive measures continues to be critical, a parallel

emphasis on long-term resilience is imperative to break the cycle of continuing response and recovery that impedes sustainable development. Sustained investment in transformative capacity—such as implementing a multi-hazard approach that builds on existing capacity and ongoing efforts—is critical. This must include an equitable and inclusive approach to capacity building that ensures women, youth, and marginalized communities are fully engaged in this transformation.

A third principle is to **support and strengthen coordination, among and between regional and national entities, and across sectors and donors.** Promoting dialogue and coordination on resilience programming is essential. The assessment identified a siloed and fragmented approach as a persistent barrier to most effectively addressing multi-hazard impacts and building resilience, as well as to optimizing the resources available through the large number of varied financial institutions and donors.

A fourth principle is to **balance regional and country-specific programming.** Several stakeholders acknowledged the important efficiencies achieved through regional programming but also stressed that implementation at the national level is severely lacking. In addition, many emphasized the importance of differentiating between small island states and mainland countries in programming. Finally, accounting for low absorptive capacity of national organizations to develop and implement country-level resilience strategies is critical.

These overarching principles provide context for implementing the seven recommended strategies, summarized in the text box and detailed in the following.

SUMMARY OF RECOMMENDATIONS TO ADVANCE RESILIENCE IN ESC

Strengthening Integrated Resilience Systems and Sectors

- **Recommendation 1:** Promote and support a multi-hazard approach.
- **Recommendation 2:** Build national capacity for sector and ministerial integration.
- **Recommendation 3:** Build sustainable and equitable economic independence to increase resilience.
- **Recommendation 4:** Build financial management capacity for resilience.
- **Recommendation 5:** Support national governments in strengthening legal frameworks for resilience.

Strengthening Citizen and Community Resilience

- **Recommendation 6:** Strengthen local capacity for resilience.
- **Recommendation 7:** Empower youth resilience.

4.2 GAPS, OPPORTUNITIES, AND RECOMMENDATIONS

Based on the findings above, the assessment identified critical gaps, opportunities, and recommendations for USAID/ESC programming. These recommendations align USAID/ESC's programming objectives with identified resilience needs, and account for efforts already undertaken by regional and national stakeholders. The recommendations reflect investments in each phase of resilience: absorptive, adaptive, and transformative. They include investments to strengthen institutional policies, technology, and overall capacity, and reflect key sectors and communities in ESC countries.

STRENGTHENING INTEGRATED RESILIENCE SYSTEMS AND SECTORS

Key Gap and Opportunity 1: While ESC countries face risks from multiple hazards, there are few systems in place to align information about response and recovery from these hazards, nor to develop integrated strategies to build mutually reinforcing resilience. These findings signal a real need for a coordinated multi-hazard approach. In addition to the range of natural hazards, epidemics (COVID-19 most recently, but also SARS and Zika) trigger complex interactions and impacts that challenge efforts to respond to events and reduce impacts. Yet, information on risk and early warning, as well as institutional roles and financial resource availability remain siloed by hazard. For example, disaster risk management approaches are not designed to confront and address simultaneous, cascading, or consecutive disaster events and other risks that compound community vulnerability, such as the convergence of public health crises and hurricanes (e.g., COVID-19 and Hurricane Laura). Mechanisms are needed to facilitate risk-informed and evidenced-based decision-making at all levels.

USAID/ESC already has experience supporting a multi-hazard approach. USAID/ESC partnered with CIMH on an activity to strengthen MHEWS and integration of impact data into multi-hazard impact-forecasting and decision-support platforms. As part of the Caribbean Climate Resilience Initiative, USAID/ESC is providing technical assistance and engaging with a range of stakeholders to elaborate on the Caribbean Resilience Framework. There is an opportunity to build on these efforts to ensure the framework promotes a robust multi-hazard approach.

Recommendation 1. Promote and support a multi-hazard approach. Support the development and implementation of an integrated multi-hazard approach to disaster risk management and climate change adaptation that maximizes effectiveness and efficiency.

Support the co-design process of an integrated multi-hazard approach that engages a broad range of partners and stakeholders to enhance stakeholder collaboration, buy-in, and interaction in the region.

- Support coordination of Centers of Excellence in disaster risk management and climate change adaptation, to develop a shared vision, resilience platform, and model policy that integrates disaster risk reduction and climate change adaptation efforts—at regional and national levels.
- Support establishment of an MHEWS consortium to better plan for, design, and communicate multi-hazard preparedness, response, recovery, and mitigation information.

Support development of technical capacity to address systemic weaknesses in absorptive, adaptive, and transformative resilience capacities.

- Support improved data analysis, interpretation, and sharing, including multi-hazard, multi-sectoral, and multi-level mapping of natural hazards and climate change projections in ESC countries.
- Support capacity strengthening for multi-hazard data collection, analysis, visualization, and communication to inform evidence-based decision-making and building a culture of safety.

- Support the finalization and implementation of the Caribbean MHEWS Strategy (with a focus on impacts-based forecasting enhanced community-level early warning system mechanisms; social protection; and awareness and use of risk information).
- Build on ongoing efforts (including in Antigua and Barbuda) to improve communication of early warning through a Common Alerting Protocol that integrates all the early warning system sectors into a common format and reaches at-risk communities with culturally appropriate communication products.
- Support development of pre-disaster plans for post-disaster reconstruction and rehabilitation that facilitate the proactive transformation from vulnerability to resilience and align with development financing strategies.
- Support tabletop exercises for multi-hazard disaster response including low frequency, high-impact risks (e.g., earthquakes, tsunamis) countries are underprepared to address today.
- Support a standardized approach for training of disaster risk managers on post-disaster needs assessment and response.
- Support development of a standardized approach and training on multi-hazard monitoring and evaluation systems to enable institutions to monitor progress, identify gaps, and make evidence-based decisions for improving disaster management.
- Support improved coordination of humanitarian assistance through development of a supply chain management hub, and unified legal frameworks for customs procedures in the event of a disaster, and training of key personnel (e.g., airport and port operators, and customs agents).

Support national-level implementation of components of a multi-hazard approach in select ESC countries, focused on improving the enabling environment for an integrated approach to comprehensive disaster management and climate adaptation that includes policy development, institutional coordination, early warning system improvement, and financing aligned with implementation. Work with CDEMA and its member countries to identify interested and suitable ESC countries to build and implement a multi-hazard approach.

- Review CDEMA's disaster risk management national capacity audits, to characterize countries' current policy, institutional, early warning, and financial capacities, and identify suitable pilot countries based on a set of pre-defined criteria (e.g., county interest, current capacity, relevance to other ESC countries).
- Apply CDEMA's MHEWS checklist to selected countries to develop an investment roadmap for a multi-hazard approach that addresses current and potential future risks.
- Engage youth and women specifically in the co-development process to ensure strategies meet the needs of the most vulnerable and provide opportunities for community leadership and inclusive economic growth.

Key Gap and Opportunity 2: Stakeholders highlighted the sensitivity and interdependency of different sectors to natural hazards and climate change. Tourism-dependent economies are highly sensitive to natural hazards because they are built on the premise of biodiversity richness and health, and rely on functional infrastructure services (e.g., power, water, and information and communications technology)—all of which are impacted by natural hazards and climate change. Essential public services—including health care, education, emergency response, and public safety—likewise rely on robust power, communications, and transport systems. Yet, the many stakeholders working to protect and restore infrastructure and services in a complex system with multiple sectors and goals are likely to default to siloed work unless collaboration and communication are carefully included in the design and management of a multi-hazard approach. In addition, weak inter-ministerial collaboration and coordination compounds the governance challenge. Risk management is often not elevated within the

government hierarchy; this leads to poor coordination and lack of financing of cross-sectoral initiatives to build resilience. Given the limited capacity of most sectoral ministries to implement existing strategies and plans, better coordination across sectors and ministries could make optimal use of human capital and use resources more efficiently to address natural hazards.

This opportunity aligns with CDEMA Priority Area #3 within the Comprehensive Disaster Management Strategy 2014–2024: improved integration of comprehensive disaster management at sectoral levels. Additionally, as part of the Caribbean Climate Resilience Initiative, USAID/ESC already supports sectoral resilience, such as programming for information and communications technology infrastructure for resilience.

Recommendation 2: Build national capacity for sector and inter-ministerial integration. Promote coordination and information sharing between disaster risk management and sector agencies and support technical and institutional development to strengthen national capacity to address multiple hazards and climate change.

Support dialogue to elevate risk management to a ministerial or departmental level, signaling an increase in political will and standing, enhancing the coordinated approach to sectoral investments in the face of multiple hazards, including climate change, and addressing resource challenges.

- Assess lessons learned from countries where disaster risk reduction and climate change governance were elevated, including from Dominica's creation of the Climate Resilience Execution Agency of Dominica, Grenada's formation of a new Ministry of Climate Change, Environment, Fisheries, and the Ministry of Disaster Preparedness, Management, and Reconstruction in The Bahamas.

Promote an integrated approach to national resilience—including disaster risk management and climate change adaptation.

- Build on existing national-level, multi-sector forums to facilitate information sharing and align objectives for disaster risk reduction and climate change adaptation.
- Support alignment of disaster management and sector-related adaptation and resilience plans to address multiple natural hazards.
- Support collaboration and priority setting on resilience that engages the private sector and local stakeholders and community voices and concerns.

Support development of legislation to promote a sustainable blue economy to increase resilience in coastal areas.

- Support development of policies and governance that promote sustainable use of marine resources to build livelihoods and community resilience.
- Promote research and development that explore new opportunities in productive sectors and build capacities and markets to grow the blue economy.

Support countries' core sectors in building technical capacity and knowledge about disaster risk reduction and climate change adaptation, focusing on priority sectors and services as defined by each country. These may include energy, agriculture, tourism, water, biodiversity conservation and natural resource management.

- Provide training and technical support to sectoral agencies to build their capacity for evidence-based decision-making, including training in data collection, analysis, interpretation, geographic information systems, and communication.

- Strengthen development of national-level databases to consolidate, manage, and track climate change adaptation and disaster risk reduction projects and objectives, including through the use of geographic information systems analysis and mapping.
- Develop a shared regional repository of lessons learned and good practices, including cross-sectoral and sector-specific strategies, that is accessible and connected to national repositories throughout the region, and support national and regional forums and training to promote and accelerate scaling of effective practice.
- Support countries in conducting country-level, cross-sectoral, hazard and climate change risk assessments that include socioeconomic analysis, including through support from UWI's Disaster Risk Reduction Centre via targeted research, development of policy briefs, and technical support.
- Increase the professional profile of national practitioners through short intense subject-focused training, including, participation in the newly developed and accredited disaster risk management programs in higher institutes of education in the CDEMA system, such as Resilience Academies.

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Waterfall on Dominica

Support transition to digital, virtual platforms, as spurred by the realities of COVID.

- Develop virtual training programs and platforms to expand the reach of training and knowledge; promoting a resilient education system that is accessible, improves operational efficiency and agility, and more effectively engages stakeholders.
- Support integration of natural hazard risks into the design of information and communications technology investments to enhance resilience to natural hazards.

Key Gap and Opportunity 3: ESC countries (particularly SIDS) are highly dependent—both economically and for resources—on other countries. The COVID-19 pandemic lockdown highlighted the precariousness of mono-sector economies dependence on tourism, and the fragility of their food, energy, and water security. These critical sectors—tourism, food, energy, and water—are highly sensitive to climate change. Their interdependency can lead to cascading risks when natural hazards strike. For example, disrupted power supplies affect water availability, essential services for tourism, and the infrastructure and communications networks on which businesses rely. Economic insecurity has profound impacts on the ability to build long-term

resilience, from the community level to national and regional levels. The recovery process from the COVID-19 pandemic provides a window of opportunity to transition to more inclusive and sustainable economies, while building resilience to natural hazards and climate change. For example, countries that are dependent upon oil imports are eager to see a shift from a brown economy (fossil fuel-driven development) to a blue-green economy that supports both energy security and climate change goals. Countries increasingly dependent on tourism have a renewed interest in diversifying their economies.

As part of the Caribbean Climate Resilience Initiative, USAID/ESC already plans to draw on lessons learned from the COVID-19 pandemic to strengthen community resilience. USAID's Caribbean Energy Initiative focuses on building energy sector resilience across the region, in recognition of the critical role a steady, reliable energy supply plays in the daily economy of the region and in post-disaster recovery. In addition, efforts to build a resilient economy support USAID's work with countries along their Journey to Self-Reliance through locally sustained results, mobilization of public and private revenues, strengthening local capacities, and accelerating enterprise-driven development. USAID's Over the Horizon initiative points to the identification and support for programming in a "world altered by COVID-19" (USAID 2020c).

Recommendation 3: Build sustainable and equitable economic independence to increase resilience and self-reliance. Support integration of resilience to natural hazards and climate change into emerging national priorities for energy, food, and water security and greenhouse gas emission reductions.

Support resilience and energy security in ESC countries.

- Integrate resilience to natural hazards, incorporating climate change, into the USAID's planned Caribbean Energy Initiative programming, ensuring consideration of these risks in asset siting and location, measures to protect or harden to storm and seismic risks through nature-based or construction design approaches, and development of distributed energy systems.
- Support countries on their low emissions development pathways by ensuring operations and investments in renewable energy (solar, wind) account for potential hazards, including hurricanes, earthquakes, sea level rise, etc.
- Advance integration of resilience into key sectors by mobilizing local funds in a revolving climate change fund, by integrating renewable energy into sectoral planning, and by including energy in their NDCs and moving towards a low carbon development and climate resilient path.
- Enhance regional investments in energy resilience. For example, CCRIF SPC's newest parametric insurance product (developed in close collaboration with Caribbean Electric Utility Services Corporation) covers transmission and distribution lines for the electric utility sector; complementary investments could support resilient recovery and rehabilitation.

Build on recent innovations in agriculture to increase food security of import-dependent countries and strengthen agricultural-based livelihoods while increasing the resilience of agriculture to natural hazards and climate change.

- Recruit and incentivize young entrepreneurs in climate-smart agriculture, agricultural processing, agricultural innovations, and market development for agricultural products.
- Strengthen agriculture extension programs, including training of officers who engage farmers, fishers, and others—on both the impacts of climate change on key crops, livestock and fisheries, and climate resilient agriculture techniques and innovations.
- Support and expand development and delivery of education and training in climate-smart agriculture through extension programs and demonstration farms and regional country exchanges as appropriate.

Support blue (marine and coastal-based) economy efforts to reignite economic growth, reduce unemployment, improve food security, and reduce overall poverty, while building resilience to natural hazards and climate change.

- Support education on and investment in sustainable fisheries and marine-based livelihoods. Identify and support synergies among sustainable marine systems, tourism, and food security.
- Incorporate natural capital valuation into public accounting, so the costs, benefits (including resilience co-benefits) of investments in green infrastructure can be properly included in feasibility assessments.
- Support the development of a training course on the design and implementation of Payment for Ecosystem Services to community livelihoods and resilience.

Support resilience and water security in ESC countries.

- Support technical training and capacity building in climate resilient water resource management.
- Support implementation of water resource management to build resilience to extreme storms and droughts, including efforts to use cleaner energy sources, decentralize water storage, promote rainwater harvesting at the household and community level, and improve rainwater runoff to replenish aquifers.
- Support improved water and sanitation infrastructure to build resilience and resource efficiency, including projects to rehabilitate deteriorated wastewater treatment facilities and leaking water supply infrastructure, modernize water supply and sewer systems, reduce network water loss, improve energy efficiency, and improve wastewater treatment operations.

Key Gap and Opportunity 4: Financial losses caused by natural hazards continue to rise; ESC countries face significant fiscal risk and major budget volatility due to economic losses caused by natural hazards. As such, indebted ESC countries struggle to move beyond disaster response towards mitigation and broader resilience. In addition, small and medium enterprises are hard hit by natural hazards and impacts to infrastructure services. There is opportunity to coordinate investment in public financial management with disaster risk financing activities. There is also an opportunity to align investments to improve the business enabling environment with resilience building of small and medium enterprises.

Through the Caribbean Climate Resilience Initiative, USAID/ESC is already supporting the financial resilience of small- and medium-sized enterprises through design of a post-disaster stimulus program and incentives. In addition, a key component of USAID/ESC's Climate Change Adaptation Program 2016–2020 with CCCCC included fostering climate financing to support scale up and replication of sustainable adaptation initiatives.

Recommendation 4. Build financial capacity and financial products that support and sustain integrated resilience. Invest in financial management capacity that builds both national government and private sector actors' capacity to absorb, adapt to, and mitigate impacts from multiple and cascading natural hazards.

Improve participation and literacy of disaster risk managers, sector planners, and ministries of finance and planning, in the planning and development of risk management financing. This should include the development of national budget reserves and contingencies for addressing more frequent risks, such as hurricanes, and the incorporation of disaster risk financing instruments designed to address less frequent, more severe risks, such as tsunamis.

Support efforts to align existing regional and national disaster risk and adaptation financing and investments to support multi-hazard relief, response, and reconstruction.

- Establish a model resilience financing strategy that engages multilateral and bilateral donors, financial institutions, and private sector actors (e.g., CCRIF SPC) to align funding and investment strategies.
- Promote funding strategies that sustain core operational programs and personnel in regional and national institutions.

Support national legislation and capacity for alternative financing mechanisms to support all areas of disaster and climate change resilience.

- Support the establishment of a disaster risk resilience reserve and contingency funds to provide flexibility, central accountability, and efficiency in the implementation of preparedness, mitigation, response, and recovery measures in a multi-hazard environment.
- Support countries in strengthening national-level institutions, mechanisms, and technical capacity needed to access and manage international climate finance resources, in collaboration with regional actors.

Assess participation in or creation of blended finance products that catalyze high-impact private sector investments and advisory projects where actual or perceived risks are too high for commercial finance alone (these products might include risk sharing products, lower interest rates, or lower returns for equity investments).

Further improve the access of small- and medium-sized enterprises to climate adaptation finance to strengthen value chain resilience, local livelihoods, and national economies.

- Build on ongoing efforts supported by CCRIF SPC to develop micro-insurance products that combine risk reduction and insurance for farmers, fishers, market vendors, and small entrepreneurs.
- Ensure the development and marketing of financial products designed to support the needs of women and youth entrepreneurs and small- and medium-sized enterprises.

Key Gap and Opportunity 5: A key driver of comprehensive disaster risk management is a risk-informed legal framework. Existing (promulgated) disaster-based legal frameworks in ESC countries are predominantly inadequate, limited in scope, and outdated. With the exception of Barbados, promulgated national legislation frameworks emphasize emergency management, such as response and recovery, and generally ignore disaster planning, prevention, and climate change adaptation. Further, existing legislation and policies generally fail to address the multi-hazard nature of disasters, and the underlying stressors that contribute to risk, such as natural resource degradation, poverty, and differentiated sensitivities across communities. In addition, associated regulatory compliance is inadequate. Finally, a lack of public consultation during the development of legal frameworks hindered awareness building and uptake. As a result, current national legal instruments have limited application, implementation, and enforcement. To address this problem, CDEMA and partners developed the Model Comprehensive Disaster Management Legislation and Regulations for countries to use as a basis to develop country-specific legislation (CDEMA 2013a). However, promulgation and development of these policies is lagging, due in part to insufficient resources and capacity, and absence of political will. There is an opportunity to build on draft comprehensive disaster management legislation for promulgation, through increased participation, and better integration of a multi-hazard approach.

Recommendation 5: Support national governments in strengthening legal frameworks for resilience. Support countries in reviewing and updating legislation to incorporate comprehensive disaster management, climate change adaptation, and a multi-hazard approach. Support development of mechanisms for implementation and enforcement, including securing and managing national and international funding (as addressed under Recommendation #4).

Support national governments in developing and enacting a risk-informed legal framework that prioritizes risk reduction and a resilience management system tailored to each country.

- Support the review and updating of model disaster legislation to align with an integrated all-hazards approach.
- Support the development of national multi-sectoral committees to tailor CDEMA's model legislation and policies to the needs of each respective country. These committees should also be charged with the responsibility to monitor and advance the legislation and policies through the existing legal infrastructure until it is enacted by the legislature.
- Support national governments in allocating the necessary resources, including financial and logistical resources as appropriate, to develop and implement national policies, laws, and regulations in all relevant sectors.
- Support the development of supplementary policies and regulations that address human-induced stressors that could exacerbate risks, such as strengthening building codes to address risks to physical infrastructure, providing community-level health care and social services, and addressing natural resource degradation. These should also include provisions to avoid creation of new risks, include appropriate gender considerations, and address other special needs or vulnerable populations.

Establish national and international accountability mechanisms to ensure adherence to regulatory and institutional frameworks.

- Support countries in establishing an institutional monitoring, compliance, and accountability measurement framework to create and support a culture of accountability and support the adherence to disaster risk reduction policies and regulations.
- In accordance with the Sendai Framework, support countries in establishing an incentive mechanism aligned with the accountability measurement framework, to encourage local level compliance with the disaster risk reduction policies and regulations. These incentives could include, but would not be limited to, incentives for adhering to urban planning regulations, building codes, environmental resource management, and general safety standards.

Support countries in implementing fully participatory disaster risk management legislation, policies, and plans that empower communities and increase stakeholder buy-in.

- Support meaningful community engagement in identifying solutions and assessing the efficiency of proposed disaster risk management legislation, policies, and plans, to increase the effectiveness of strategies and reduce vulnerabilities.
- Support the collection of actionable data from communities, including demographic data, geospatial data locating critical infrastructure and public facilities and services, and information about the location and characteristics of observed hazard impacts. This information will support greater public acceptance and adherence, during the mitigation of disaster events and resilience-building activities.

STRENGTHENING CITIZEN AND COMMUNITY RESILIENCE

Key Gap and Opportunity 6: Communities represent an enormous strength, a pillar of ESC societies. Strong social dynamics and healthy, functioning ecosystems are critical to adaptive capacity–increasing a community's and region's ability to respond effectively to both chronic stresses and extreme hazards. However, many ESC communities have limited capacity to prepare for natural hazards and limited economic resilience to bounce back. Stakeholder consultations indicate community capacity building and local community resilience are under-resourced relative to donor funding at the regional level. In particular, there are many opportunities to build capacity of small and medium enterprises, as well as to support ecosystem-based livelihoods, integrating resilience building into core community development.

USAID/ESC already supports community-level resilience programming through the Caribbean Climate Resilience Initiative in partnership with CDEMA, with particular attention to marginalized populations and including investing in community-level activities informed by the Caribbean Community Risk Information Community Tool. USAID/ESC is also working with Inter-American Foundation through the Building Community Resilience in the Eastern and Southern Caribbean Program to strengthen disaster mitigation and resilience at the community-level through grantmaking, capacity building, and knowledge exchange among local, grassroots organizations.

Recommendation 6: Strengthen local capacity for resilience. Support local capacity building and community-level resilient livelihoods, including nature-based solutions.

Support design and implementation of funding mechanisms to provide community-level support for comprehensive resilience building.

- Support trusted CSOs and NGOs to act as intermediaries to design and implement effective grant mechanisms that target community resilience building.
- Support the establishment of community-based partnerships that bring together communities, researchers, innovators, and entrepreneurs o co-design solutions to community-level problems and building resilience.
- Promote donor coordination on harmonized investments in support of resilient communities.

Support community-based programming that builds comprehensive resilience and sustainable and inclusive economic development.

- Promote and strengthen environmentally friendly enterprises that support blue-green economic goals to bolster sustainable development while building resilience.
- Support development of innovative approaches to expand outreach and education on disaster risk reduction and climate change to marginalized and poor communities and populations, especially women and youth.

Support scaling of effective community-based programing to build broader community-level resilience across communities and countries.

- Share lessons from Antigua and Barbuda's revolving fund which helps vulnerable households and businesses meet new built infrastructure standards to withstand extreme weather events.

Key Gap and Opportunity 7: Youth are particularly at risk from natural hazard impacts due in part to their limited voice and empowerment, lack of access to resources, and high unemployment. At the same time, a lack of human capacity is cited as a significant barrier to disaster preparedness, response, and reconstruction across the ESC region. COVID-19 demonstrated the significant potential of youth to contribute to disaster preparedness and response, and to become technologically savvy future leaders and entrepreneurs. Youth can be an essential cornerstone to community and national resilience, yet their potential contributions are not yet mobilized and empowered. To fill the key gap of youth engagement on risks from natural hazards in the region, USAID/ESC is uniquely positioned to build on ongoing experience to empower youth to contribute to the resilience of their community and the region. Better inclusion of youth in decision making and program design will not only empower this population to reach their full potential but could also strengthen and transform systems.

USAID/ESC's strong history of targeting programming to support youth includes empowering at-risk youth and expanding access to education and employment opportunities, primarily to stem youth crime and violence. USAID and its partners pioneered the concept of positive youth development, recognizing youth participation as vital to development. USAID/ESC recently conducted an assessment to integrate positive youth development into strategic priorities for the Regional Development Cooperation Strategy, and specified recommendations to engage youth in climate change resilience programming, incorporated in Recommendation 7 (Nicholson and Walker 2020).

Recommendation 7: Engage and empower youth resilience. Engage and invest in youth—as designers and leaders in programming interventions—empowering them through the development of initiatives that promote positive youth development, economic security and resilience, and new opportunities that build energy and food security.

Engage youth in resilience planning, program design, and implementation.

- Ensure that youth are included explicitly in climate change project designs with results indicators that produce impact data on youth by age cohort and gender.
- Support youth groups to become more engaged in community-based climate resilience activities, such as participation on volunteer Community Emergency Response Teams.
- Encourage regional entities and national-level governments to engage youth in resilience initiatives.

Raise youth awareness about climate change and risks to mobilize action and engagement.

- Raise youth awareness of disaster risk reduction, climate change adaptation, and blue-green livelihood opportunities by integrating these topics into formal primary, secondary, and tertiary school curricula, and training primary and secondary school teachers to teach them.
- Support dissemination of key information through targeted social media and celebrity campaigns to reach youth populations.

Provide support to training of youth in new skills and technologies that support resilience building.

- Support youth training in renewable energy technology, aligned with national policies and objectives promoting a transition away from brown technologies.
- Support youth training in climate-smart agriculture, aligned with national policies and objectives to build national food security.

- Build on ongoing government efforts and private sector (e.g., CCRIF SPC) resilience efforts that focus on youth through funding of interns, training, and educational opportunities.

Provide support to increase employment opportunities for youth and young professionals in resilience-related professions and occupations.

- Work with governments and the private sector to promote opportunities for skilled youth in disaster risk reduction and climate change adaptation.
- Work with academic institutions, governments, and the private sector to provide internships and mentoring programs for young professionals, providing a pathway to professional growth while expanding the capacity and resources of institutions.

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Trinidad and Tobago

ANNEX A: COUNTRY PROFILES

ANTIGUA AND BARBUDA
A.1 COUNTRY CONTEXT

ENVIRONMENTAL, SOCIAL AND ECONOMIC CONTEXT

Environmental	The islands of Antigua and Barbuda are low-lying and relatively flat. As a result, the islands lack a significant stream network and surface water. Antigua's perimeter is a corrugated shoreline which cradles beaches and bays. Barbuda features a large lagoon of conservation significance that supports biodiversity. The country experiences a dry season (January–April) and wet season (August–November). The historical (1901–2016) mean annual temperature is 25.3°C and historical mean annual precipitation is 2468.2 mm. Projections indicate that mean annual temperature will rise by 1.3°C (0.9°C to 1.9°C) and annual precipitation will decrease by 45.7 mm (-277.2 mm to 101.2 mm) by 2040–2059.[4] Annual average rainfall is projected to decrease 30 to 50 percent by 2090 (O'Marde 2017; World Bank 2020a; Government of Antigua and Barbuda 2015a).
Social	The country has a population of just under 100,000 people and the median age is 33 years. Approximately 97 percent of the population resides in Antigua. The country ranks relatively high on the UNDP's Human Development Index for the OECS region, based on life expectancy, literacy rate, and GDP per capita. The country has experienced immigration from other CARICOM countries due to comparatively strong economic performance in the tourism sector. However, there are high levels of inequality, with an unemployment rate of 14.1 percent and 29 percent living in poverty or at risk of falling into poverty. The highest proportion of unemployed are those under 24 years old (O'Marde 2017; PAHO 2017).
Economic	Tourism is the primary economic driver in the country, though heavy dependence on the sector has led to volatility in economic growth. Meanwhile, agriculture is responsible for only 1.8 percent of GDP. Critical infrastructure systems that support the country are concentrated around the capital of St. John's. The country relies primarily on desalination for potable water and groundwater yet experiences daily deficits (O'Marde 2017). The country suffers from high debt burden; fiscal stabilization and debt management are among priorities in the national development agenda.

INSTITUTIONAL CONTEXT AND LEGAL FRAMEWORK AFFECTING RESILIENCE

Key disaster management legislation are the Emergency Powers Act of 1957 and Disaster Management Act of 2002. The latter established a national Director of Disaster Preparedness and Response position and the National Disaster Preparedness and Response Advisory Committee. The multi-sectoral Committee is responsible for management of a national disaster policy and plan. Disaster management is implemented through the National Office for Disaster Services (NODS) which coordinates closely with CDEMA. The Meteorological Service monitors and forecasts weather and coordinates with NODS on early warnings. The Department of Environment leads programs related to climate resilience.

4 Projections represent the model ensemble median under the high emissions scenario (Representative Concentration Pathway (RCP) 8.5) and the range of values in parentheses represent the 10th to 90th percentile.

Furthermore, Antigua and Barbuda serves as the eastern Sub-Regional Disaster Emergency Response Focal Point for CDEMA which supports emergency response to Anguilla, Montserrat, St. Kitts and Nevis, and the British Virgin Islands (CDEMA 2016).

The draft national comprehensive disaster management policy is intended to integrate comprehensive disaster management into national policies and decision-making across sectors (CDEMA 2013b). The Sustainable Island Resource Management Zoning Plan guides national physical development. The INDC adaptation targets were developed to complement the Sustainable Island Resource Management Zoning Plan to integrate climate change resilience into development. The 2015–2020 National Action Plan: Combatting Desertification, Land Degradation and Drought includes development of a drought response system (Government of Antigua and Barbuda 2015a).

A.2 RISK AND RESILIENCE ASSESSMENT

RISK AND RESILIENCE PROFILE

Antigua and Barbuda faces risks from storms, flooding, drought, coastal and stream erosion, and earthquakes. To add nuance to the regional risk and resilience synthesis, the following section focuses on Antigua and Barbuda's priority risks, which include risks from storms to the country's infrastructure and tourism-heavy economy and risks to the water sector. The section also characterizes the resilience capacities that are unique to the country.

Priority Risks

The country is particularly exposed to sea level rise and storm surge given the low-lying and flat terrain. As in other Caribbean countries, strong winds and heavy rain during storms pose risks to the built and natural environment, populations, and economy. Hurricane Irma (2017, Category 5, eye of the storm through Barbuda) and Hurricane Maria (2017, Category 5) caused an estimated $136.1 million in destroyed physical assets in the country, 44 percent of which was in the tourism sector and 37 percent in housing (UNDP 2019). Heavy dependence of the country's economy on tourism increases the vulnerability of livelihoods and the economy to these shocks and stressors. Following shocks, such as hurricanes and COVID-19, workers displaced from tourism return to the traditional sectors of agriculture and fisheries (O'Marde 2017 and Stakeholder consultations 2020). The country's infrastructure services may face cascading and compounding impacts from natural hazards especially because critical assets—including power generation, desalination plants, and the major port and airport—are concentrated in the capital and lack alternative services.

Recent and projected drought (plus projected declines in average precipitation) are major stressors on the country's water sector, limiting natural freshwater resources. The limited groundwater resources experience saltwater intrusion from over withdrawal and are vulnerable to saltwater intrusion from sea level rise. Deforestation, which increases runoff, constrains groundwater recharge. Desalination accounts for up to 90 percent of freshwater supply during periods of drought. Adaptation targets in the country's Intended NDC include increasing seawater desalination capacity. However, overreliance on desalination facilities, currently concentrated in the capital, increases the potential for serious consequences from storms from both direct damages of coastal facilities and cascading impacts from loss of power.

Resilience Capacities

Institutional capacity:

- Strengths: The country undertook a few initiatives to integrate disaster management across sectors. For example, the government led the Antigua and Barbuda Declaration on School Safety, including a framework for integration of comprehensive disaster management in the education sector; this Declaration has been signed by several other Caribbean countries and underpins the Caribbean Safe School Initiative.
- Weaknesses: The draft national comprehensive disaster management policy is yet to be adopted into law and disaster management is yet to be integrated in the national development strategy. Additionally, private sector involvement in disaster risk reduction, however, is limited to mostly the telecommunication sector's engagement in emergency warnings.

Knowledge and technical capacity:

- Strengths: Risk mapping in the country is relatively advanced in the region; NODS maintains hazard maps which are used by ministries across other sectors (World Bank 2010). NODS reviews earthquake monitoring information from the UWI Seismic Research Centre.
- Weaknesses: Data are outdated or low resolution to support climate change adaptation planning (Government of Antigua and Barbuda, 2017).

Human and community capacity:

- Strengths: Government-led initiatives support human capacity at the community level, especially for vulnerable populations. For example, one directive of the Department of Environment's Sustainable Island Resource Framework Fund is to provide financial support for vulnerable groups to adapt to climate change impacts, including female, single headed households; small businesses; and small-scale farmers. Additionally, NODS undertook efforts for gender-responsive disaster risk reduction, including a gender-responsive early warning system in collaboration with CDEMA and support to the Directorate of Gender Affairs on guidelines and trainings for the prevention of gender-based violence in disaster settings (Government of Antigua and Barbuda, 2019). Several CSOs such as the Red Cross and St John Association of Antigua and Barbuda work on disaster risk reduction efforts.

Photo by Phil Hauser on Unsplash
Antigua and Barbuda

- Weaknesses: While NODS facilitate community-level disaster management by providing disaster response resources and training to volunteer District Disaster Committees, response capacity at the community level can be challenging to manage due to volunteer turnover.

Financial capacity:

- Strengths: Antigua and Barbuda has successfully accessed international climate finance funding, including partnering with OECS and Grenada and Dominica for a project through the GCF (GCF 2018a). A critical financial mechanism to access these funds is the Department of Environment's Sustainable Island Resource Framework Fund, established in 2015, which serves as the primary channel for environmental and climate change funding from both international and domestic sources.

CURRENT STATUS OF THE COUNTRY'S RESILIENCE MEASURES

The table provides a snapshot of illustrative ongoing resilience measures in the country and is not meant to be comprehensive.

Program Name	Entity	Status: Year(s) and Size ($)	Description
Barbuda Housing Recovery Project (UNDP 2019f)	Sponsor: European Union Implementer: UNDP	2019–2021 $5.7 million	Housing recovery for the most vulnerable populations from Hurricane Irma damages. Capacity building of the local population enhanced to prevent and/or cope with future shocks through increased knowledge of standardized resilient construction techniques.
Resilience to hurricanes in the building sector in Antigua and Barbuda	Sponsor: GCF Implementer: Department of Environment	$46.2 million	Climate-proofing interventions for critical public service and community buildings. Mainstream climate change adaptation into the building sector. Strengthen climate information services within the building sector to facilitate early action.

SOURCES FOR ADDITIONAL INFORMATION

- Country Document for Disaster Risk Reduction: Antigua and Barbuda, 2016.
- Antigua and Barbuda Disaster Management Act.
- Antigua and Barbuda Second National Communication to the UNFCCC.

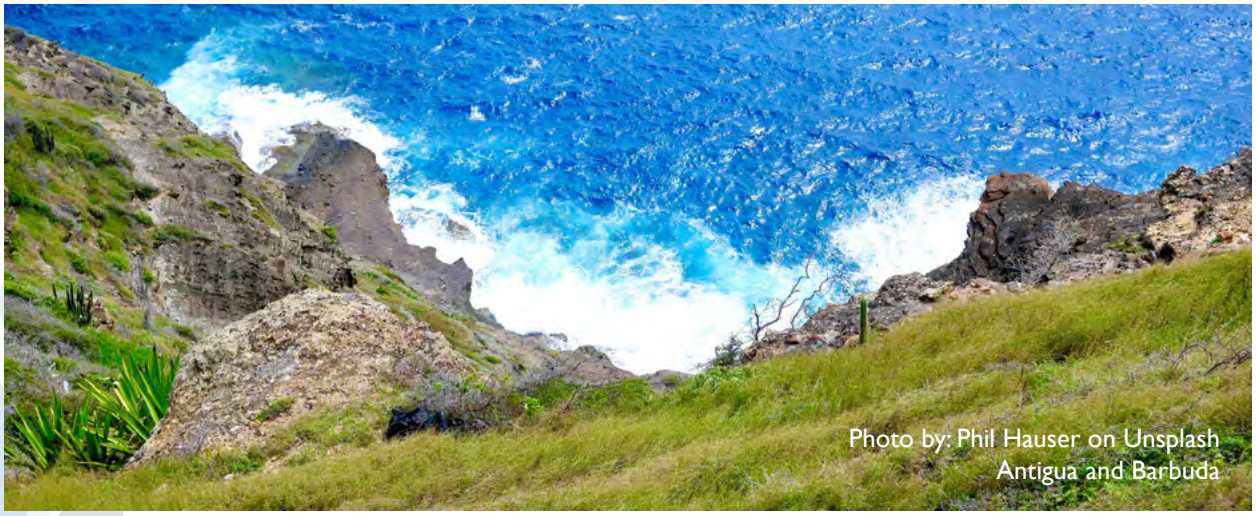

Photo by: Phil Hauser on Unsplash
Antigua and Barbuda

GUYANA
A.1 COUNTRY CONTEXT

ENVIRONMENTAL, SOCIAL AND ECONOMIC CONTEXT

Environmental	The tropical country of Guyana is located on the northeastern coast of South America. Guyana is a low-lying nation bordering the Atlantic Ocean to the north. The geography and natural landscape of the country is varied, with coastal, hilly, sandy, highland, forested, and savannah regions. Approximately 85 percent of the country's total land area is forested. Rainfall in Guyana is highly variable, and the country can be divided into climatic regions ranging from dry (annual rainfall less than 1788 mm) to extremely wet (annual rainfall greater than 4100 mm). Guyana has two rainy seasons, the first from April to July and the second from November to January. Across the country, the historical (1901–2016) mean annual temperature is 25.7°C and historical mean annual precipitation is 2375.5 mm. Projections indicate that mean annual temperature will rise by 1.9°C (1.3°C to 3°C) and annual precipitation will decrease by 36.8 mm (-330.1 mm to 362.1 mm) by 2040–2059.[5] Average sea level is expected to rise 1 to 3 meters by the end of the century (UNDP 2020c; Government of Guyana 2020a; World Bank 2020e).
Social	Guyana has a diverse population: 35 percent of African descent, 35 percent of East Indian Descent, 20 percent mixed, and 10 percent other. Ninety percent of the population of Guyana, and the country's main urban centers, are located in the coastal strip bordering the Atlantic Ocean. Of the country's population, 7.8 percent is multi-dimensionally poor, while 18.8 percent live near multi-dimensional poverty. Guyana's UNDP Human Development Index ranks in the middle tier of countries and has been increasing in recent years due to improvements in life expectancy, mean years of schooling, and gross national income. However, gender inequality persists in Guyana; for example, the female mortality rate is high compared to other similar countries. Furthermore, information from the USAID "Journey to Self-Reliance" project indicates that Guyana lags behind similar countries in the areas of inclusive development and social group equality (UNDP 2020b; UNDP 2019c; Government of Guyana 2016b; USAID 2020b).
Economic	Agriculture and mining are the most significant contributors to Guyana's GDP. Guyana is a net food exporter but face challenges processing their goods in-country due to high energy costs. The economy of Guyana grew by approximately 4.5 percent in 2019 and 4.1 percent in 2018. Real GDP expanded in 2019, primarily due to increased timber and gold production. Commercial oil production began in the country in 2020, resulting in significant economic growth and an expected increase in GDP of 53 percent (CDB 2020; IMF 2020).

INSTITUTIONAL CONTEXT AND LEGAL FRAMEWORK AFFECTING RESILIENCE

Disaster preparedness and management in Guyana is overseen by the Guyana CDC. The CDC plans and implements national-level disaster management measures, promotes the adoption of disaster loss reduction and mitigation policies, promotes and develops voluntary service groups to respond in the event of a disaster, provides disaster management training and education, and maintains a permanent staff to enhance the national capacity for disaster management services. The CDC embarked on a comprehensive disaster management program aligned with the CDEMA framework and centered around four phases: mitigation, preparedness, response, and recovery (Government of Guyana 2016a). The CDC also recently undertook an effort to draft disaster management legislation for the country. The CDC works in close collaboration with the national Office of the President, Ministry of Agriculture, Environmental Protection Agency, Red Cross, Ministry of Health, and Defense Force.

5 Projections represent the model ensemble median under the high emissions scenario (RCP 8.5) and the range of values in parentheses represent the 10th to 90th percentile.

Guyana also recently developed a National Climate Change Policy and Action Plan. Policy objectives include the establishment of climate resilient infrastructure and physical development, responsible management and utilization of natural resources, promotion of equitable participation, and decision-making based on leading scientific evidence. A strategic action plan and roadmap have been developed to implement the National Climate Change Policy and Action Plan.

A.2 RISK AND RESILIENCE ASSESSMENT

RISK AND RESILIENCE PROFILE

Priority Risks

Key risks in Guyana include coastal flooding and sea level rise, flooding due to excessive rainfall, drought, and wildfires during excessive dry periods (Government of Guyana 2016b). Guyana does not face the same risks as the rest of the Caribbean for the most part (e.g., not highly exposed to hurricanes, volcanoes, and earthquakes) and, as such, has relatively limited areas of collaboration with CDEMA.

With 90 percent of the population living in the low-lying coastal region, Guyana is at risk from sea level rise and coastal flooding. Rates of sea level rise in Guyana exceed 10 mm per year, while the global average is 2 to 4 mm per year (Velasco 2014). Subsidence due to groundwater extraction, soil compaction, and the drainage of wetlands exacerbates rates of sea level rise (UCS 2011). Sea level rise poses a threat not only to the built environment and urban centers located along the coast, but also to agriculture and the natural environment such as mangrove ecosystems. Rising sea levels also threaten freshwater resources; saltwater intrusion was already observed in the two main aquifers providing water to coastal residents.

Guyana experiences frequent flooding during the rainy seasons, affecting both the inland regions and the coast. In January 2005, heavy rainfall coupled with drainage blockages and pump malfunctions caused severe flooding in several regions. These floods affected 274,774 individuals and resulted in economic losses of $465 million. In January 2006, severe flooding occurred once again and resulted in $30 million in damages (Velasco 2014).

Guyana is also at risk from drought and is expected to see an increase in consecutive dry days due to climate change. Recent droughts in 1998 and 2009 to 2010 resulted in water rationing and extensive crop and livestock losses. Climate change will threaten agriculture production through increased competition for water resources, loss of agricultural lands due to flooding, heat stress, and increased incidence of pests and disease (Government of Guyana 2010).

Wildfires primarily occur along the coast and affect both rural and urban areas. Information on this hazard in Guyana has not been extensively analyzed.

Resilience Capacity

Institutional capacity:

- Strengths: Several frameworks and systems are in place, such as the National MHEWS Framework (2013), regional disaster risk management systems, community-based disaster risk management.
- Weaknesses: Guyana struggles with limited institutional capacity to enact disaster risk management activities and limited monitoring and enforcement (Velasco 2014). There is high duplication of initiatives and a lack of integration or harmonization across activities. The

country's Regional Democratic Councils and Neighborhood Democratic Councils have limited authority and resources to implement initiatives and plans at a sub-national level. Furthermore, there is a need for policy, legislation, and coordination across institutions to manage land and water resources at a landscape scale. Finally, transportation and communication challenges result in limited outreach and engagement to the public and reduced monitoring and enforcement of ongoing activities, particularly in the Hinterland regions (Stakeholder consultations 2020).

Human and community capacity:

- Strengths: Guyana has considerable capacity in the areas of youth crime and violence prevention through participation in multiple efforts aimed at building social resilience, including the Community, Family and Youth Resilience Program and several activities funded by the U.S. Government.
- Weaknesses: There is a need for greater stakeholder involvement in disaster management and climate adaptation decision-making implementation, including increased access to climate-related information by indigenous groups, and increased participation of women in decision-making (Government of Guyana 2020b).

Knowledge and technical capacity:

- Strengths: Technical forecasting capacity in Guyana is improving and services are well utilized. For example, the country's hydrometeorological services allow farmers to increase their planning for planting and harvesting, avoiding crop losses (Stakeholder consultations 2020).
- Weaknesses: The amount of information often exceeds the capacities of personnel to compile and analyze the data to guide planning. Guyana also struggles from high staff turnover in many key institutions, and a lack of organization and historical knowledge. There is a need to improve training to overcome these barriers and promote action and implementation. A lack of local information and data is a weak link in weather forecasting efforts in Guyana.

Financial capacity:

- Strengths: Funding commitment to address extreme rainfall and coastal flooding can be seen in the national budget, where irrigation and drainage projects were allocated $2 billion, and 'sea protection' projects $3 billion in the 2019 budget (Government of Guyana 2019; Stakeholder consultations 2020). Additionally, the country's economic profile changed in recent years and is expected to continue to change due to the emergence of an oil and gas industry.
- Weaknesses: Guyana struggles from limited financial resources and high reliance on external funding and aid, with little capacity for implementation.

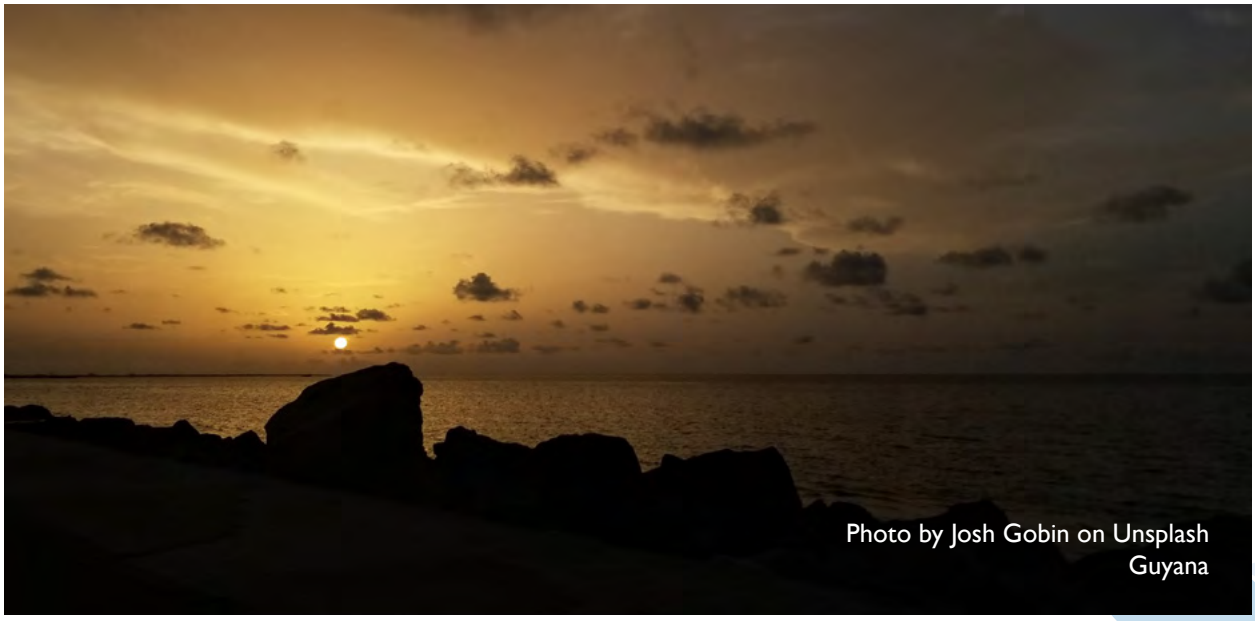

Photo by Josh Gobin on Unsplash
Guyana

CURRENT STATUS OF THE COUNTRY'S RESILIENCE MEASURES

The table provides a snapshot of illustrative ongoing resilience measures in the country and is not meant to be comprehensive.

Program Name	Entity	Status: Year(s) and Size ($)	Description
Climate Resilience Support for the Adequate Housing and Urban Accessibility Program in Georgetown, Guyana	IDB	Approved for implementation in 2017 $500,000	Technical Cooperation designed to support the Government of Guyana with the integration of climate adaptation and resiliency aspects into the Adequate Housing and Urban Accessibility Program, ranging from site selection to buildings construction.
Real-time flooding forecast	Implementer: CIMH Funder: CARICOM/Japan Friendship Fund	N/A	This project couples a physically based numerical hydrological model capable of capturing changes in some watershed characteristics to a numerical weather prediction model. The coupled modeling framework will be applied to selected catchments in Guyana.

SOURCES FOR ADDITIONAL INFORMATION

- Progress and Challenges in Disaster Risk Management in Guyana.
- Guyana Second National Communication to the UNFCCC.
- National Integrated Disaster Risk Management Plan and Implementation Strategy for Guyana.
- RE-ACT (Resilient Action Guyana): Increasing climate resilience of vulnerable ecosystems and rural communities in Guyana's coastal areas.

TRINIDAD AND TOBAGO
A.1 COUNTRY CONTEXT

ENVIRONMENTAL, SOCIAL AND ECONOMIC CONTEXT

Environmental	The island of Trinidad is the most southern island of the Caribbean. Tobago, volcanic in origin, has one main central ridge. The highest point is in the northern range of Trinidad, El Cerro del Aripo, which has an elevation of 940 meters. The historical (1901–2016) mean annual temperature is 26.1°C and historical mean annual precipitation is 1605 mm. Projections indicate that mean annual temperature will rise by 1.4°C (1.0°C to 2.1°C) and annual precipitation will decrease by 60 mm (-357.1 mm to 218 mm) by 2040–2059 (Clark et al. 2019; Government of Trinidad and Tobago 2014; World Bank 2020j).[6]
Social	Trinidad and Tobago has a population of 1.4 million people. The country is a multi-ethnic, multi-religious country. The literacy rate is 98.8 percent. Males outnumbered females in enrollment in primary and secondary school, though there are more females receiving tertiary level education. In 2019, the global gender gap index for Trinidad and Tobago was 0.76 (World Economic Forum 2020). GGI is a compass to track progress on relative gaps between women and men on health, education, economy, and politics. The unemployment rate is 3.8 percent (Government of Trinidad and Tobago 2018; Government of Trinidad and Tobago 2014).
Economic	Trinidad and Tobago is a middle income, energy rich country with an estimated GDP of $23.99 billion (World Bank 2019) and inflation rate of 0.4 percent. The economy is largely supported by the petroleum and manufacturing industries, services including tourism, and to a lesser extent agriculture. The fluctuating energy prices has caused volatile economy for Trinidad and Tobago. The energy sector, although the largest contributor to GDP, is not a significant employer of labor. In Tobago, tourism is the main economic sector, surpassing agriculture which was historically the main economic driver (Clark et al. 2019).

INSTITUTIONAL CONTEXT AND LEGAL FRAMEWORK AFFECTING RESILIENCE

The primary disaster management legislation is the Disaster Measures Act of 1978. The Act gives the President authority for proclamation of a disaster area. In addition, there are several other national disaster management related policies such as the Comprehensive Disaster Management Policy Framework 2007, the Shelter Policy, the National Flood Risk Management Policy, the Critical Facilities Protection Policy Framework, the Draft Hazard Mitigation Policy, the Crisis Communication Policy, the Trinidad and Tobago National Earthquake Response Plan, the National Response Framework, and the National Oil Spill Contingency Plan (Government of Trinidad and Tobago 2013). It should also be noted that Trinidad and Tobago are in the process of revamping their disaster risk reduction policies to be more aligned with comprehensive disaster management and the Sendai Framework. This was deemed necessary because most of the existing policies are more than 10 years old.

Trinidad and Tobago's draft Comprehensive Disaster Management Policy Framework 2007 aligns with CDEMA's comprehensive disaster management framework with cross-cutting themes of broad-based stakeholder consultation and strengthening institutional frameworks (Government of Trinidad and Tobago, n.d.). The local disaster management agencies are committed to the framework as the country strengthens its disaster risk management and resilience.

6 Projections represent the model ensemble median under the high emissions scenario (RCP 8.5) and the range of values in parentheses represent the 10th to 90th percentile.

Disaster management is implemented through ODPM, the national agency which coordinates closely with CDEMA. Through the ODPM, Trinidad and Tobago serves as the southern Sub-Regional Disaster Emergency Response Focal Point for CDEMA which supports emergency response to Guyana, Grenada, and Suriname (CDEMA 2016). The Meteorological Service monitors and forecasts weather and coordinates with ODPM on early warnings. Additionally, there is a bottom-up approach where local level disasters are managed by the Ministry of Rural Development and Local Government through the disaster managers of 14 regional corporations. The Tobago Emergency Management Agency serves the island separately and trains and supports a strong volunteer Community Emergency Response Team for community-level disaster response.

The Environmental Management Authority and the Ministry of Planning and Development lead programs related to climate resilience (Trinidad and Tobago EMA, 2017). The National Climate Policy, written in 2011, speaks to building resilience of human and natural systems to adapt to climate change. The Integrated Coastal Zone Management Policy Framework, drafted in 2012, provides an integrated approach aimed at maintaining and enhancing the functional integrity of the coastal resource systems (Integrated Coastal Zone Management Inter-Ministerial Committee 2020).

A.2 RISK AND RESILIENCE ASSESSMENT

RISK AND RESILIENCE PROFILE

The following section summarizes the country's priority risks, which include risks from seismic, hydrological, and meteorological disasters as well as socioeconomic vulnerabilities. The section also characterizes the resilience capacities that are unique to the country.

Priority Risks

Relative to the other islands in the Caribbean, Trinidad and Tobago is less exposed to hurricanes due to its location in the southernmost portion of the Caribbean. However, based on the climate, topography, and urban infrastructure, the islands of Trinidad and Tobago are highly susceptible to risks from floods and landslides. During the rainy season, the islands experience heavy rains that trigger flooding in low-lying urban centers and agricultural farms as well as landslides along the undulating mountain ranges. For example, in 2019, Greenvale and the surrounding community received intense rainfall that would typically occur during a hurricane. Some homes reported being flooded with up to eight feet of water (Julien 2018). Land conversion is a stressor; according to 2007 estimates 11.3 percent of the land is densely covered by houses or other buildings. This loss of open space and permeable surfaces contributes to flood risk.

On the opposite end of the spectrum, the islands also experienced long dry spells without rain, which resulted in meteorological and hydrological drought. For example, between 2001 and 2010, the four main reservoirs in Trinidad and Tobago recorded lower than average reservoir levels (Beharry et al. 2019). Projections suggest declines in rainfall and increases in temperature over the next several decades, which implies further water stress for both islands. Most of the farmers on these islands utilize water from the rivers for crop irrigation, and the dry spells that occur during the months of January to May every year have negatively affected the farmers.

Coastal erosion is also a priority risk in the country. Erosion along the southern-western and eastern coastlines prompted the relocation of several households, and in some instances, entire communities. For instance, in 2018, numerous Cedros residents were evacuated from their homes after houses collapsed due to a minor earthquake coupled with persistent coastal erosion along the southern-western peninsula of Trinidad (Silva 2019).

Tourism is the main revenue earner for the island of Tobago. Many of the beaches in Tobago are impacted by coastal erosion. In addition to tourism infrastructure, transportation infrastructure is adversely affected by coastal erosion. One beach on the windward side of the island experiences an erosion rate of 0.67 month/year. The main road which connects several communities is directly affected by the coastal erosion. If mitigation works are not implemented, it is expected to be in a critical state in less than seven years.

Several major fault lines pass through Trinidad. In 2008, Trinidad experienced a 6.9 earthquake which was widely felt in the Eastern Caribbean. The earthquake caused damages to home and buildings as well as electricity outages.

Resilience Capacity

Institutional capacity:

- Strengths: The country has multiple draft disaster-related policies in place that align with CDEMA's comprehensive disaster management framework. There is also a strong working relationship between CDEMA and the ODPM.
- Weaknesses: The primary piece of legislation governing disaster management in Trinidad and Tobago–the Disaster Measures Act–is currently 42 years old and does not address disaster mitigation or reduction of current or future risks, allocate disaster financing, or establish the necessary mechanisms and incentives to ensure high levels of compliance with disaster risk management codes and regulations. There is also low adherence to building and planning regulations in Trinidad and Tobago, which leads to unplanned development in hazard prone areas.

Knowledge and technical capacity:

- Strengths: Several initiatives bolster the technical capacity across the twin island state. For example, UWI Seismic Research Centre hosts a disaster inventory database of earthquakes (UWI 2011), though it only includes hazard information with limited information related to economic, social, and environmental impact. Additionally, in 2018, the local Meteorological Service implemented a new local color-coded early warning system for hydrometeorological hazards. The structure of the warnings conforms to the format of the Common Alerting Protocol, an international standard for emergency alerts and public warning (WMO 2020).
- Weaknesses: Trinidad and Tobago lacks a nationwide MHEWS. Tobago currently has a MHEWS located in the Crown Point, Bon Accord, Canaan, and Scarborough urban centers, but these systems do not have the ability to warn other urban and rural communities in Tobago or Trinidad.

Human and community capacity:

- Strengths: The ODPM produces materials and leads countrywide public awareness programs and projects to engage communities, families, and even the business sector on disaster preparedness and mitigation. For instance, Communities Organized and Ready for Emergencies (CORE) is a partnership program among the ODPM, Ministry of Local Government, other government ministries and agencies, as well as NGOs, community-based organizations and the private sector. CORE is a community outreach initiative through which disaster risk reduction information is disseminated to citizens (Government of Trinidad and Tobago 2011). It also acts as a direct platform for residents to voice disaster management and preparedness concerns.
- Weaknesses: While CORE facilitates community-level disaster management by providing disaster response resources and training to volunteers, response capacity at the community level can be challenging to manage due to the lack of volunteers and financial support. There is also the absence of mechanisms to exchange lessons learned across communities on successful community-level disaster resilience experiences (IDB 2014).

Financial capacity:

- Strengths: In the event of a major disaster, financial assistance is available to the Government through several institutions and funds: the CCRIF, UN Central Emergency Relief Fund, the Inter-American Emergency Aid Fund and the Caribbean Development Bank. In addition to these resources, the Government of Trinidad and Tobago established a Heritage and Stabilization Fund. The purpose of the fund is not explicitly intended to be used in the aftermath of a disaster, though if needed, may be a source of relief assistance after a national disaster.
- Weaknesses: The downturn in Trinidad and Tobago's economy due to the recent decrease in oil prices reduced budgetary allocations across the government, including for ODPM. For instance, in 2012, the ODPM received approximately one third of its requested budget allocation for disaster risk reduction activities. This lack of financial capacity weakens the organization's ability to develop further mitigation, preparedness, and response initiatives.

CURRENT STATUS OF THE COUNTRY'S RESILIENCE MEASURES

To date, Trinidad and Tobago undertook a few programs designed to build resilience. The table provides a snapshot of illustrative ongoing resilience measures in the country and is not meant to be comprehensive.

Program Name	Entity	Status: Year(s) and Size ($)	Description
Disaster risk reduction Sensitization for Primary and Secondary School	ODPM and Ministry of Education	2020	This educational outreach forms part of the ODPM's Safer Schools Programme, which is geared towards improving knowledge and understanding of severe hazards and disasters risk among children, youth, communities, and stakeholders.
Improving the monitoring system for climate change impacts on the agriculture sector	UN and FAO	February 2020–August 2021 (18 months)	The project's goal is to build capacity to protect, restore and diversify the livelihoods of families that depend on agriculture by strengthening food and nutrition security and by enhancing the country's ability to respond to climate change.
National Disaster Preparedness Baseline Assessment	Pacific Disaster Center	2019–2020	An initiative to assess disaster risk and preparedness nationally, and within each of its sub-national administrative divisions.

SOURCES FOR ADDITIONAL INFORMATION

- Disaster Risk Reduction Document, Trinidad and Tobago, 2014.
- Trinidad and Tobago 3rd National Communication to the UNFCCC.
- Draft Comprehensive Disaster Management Policy Framework for Trinidad and Tobago.

SAINT LUCIA
A.1 COUNTRY CONTEXT

ENVIRONMENTAL, SOCIAL AND ECONOMIC CONTEXT

Environmental	Saint Lucia's land area is approximately 616 km^2. The island is 42 km long and 22 km wide at its widest point, and a coastline of approximately 158 km. It is mountainous and rugged in topography, with steep slopes cut by fast-flowing rivers. The narrow coastal strip which circumscribes the island, is characterized by concentrations of haphazard and unplanned development. Saint Lucia experiences a tropical maritime climate. The historical (1901–2016) mean annual temperature is 25.6°C and mean annual precipitation is 2330.1mm. Projections indicate that mean annual temperature will rise by 1.3°C (0.9°C to 2°C) and annual precipitation will decrease by 42.8mm (-259.4mm to 128.5mm) in 2040–2059[7] (Thomas-Louisy 2014; Government of Saint Lucia 2018; World Bank 2020h).
Social	Saint Lucia has a population of 177,301 people (Saint Lucia CSO 2019). The average population growth rate is 0.50 percent. The country is multi-ethnic and multi-religious. Saint Lucia's Human Development Index value for 2018 is 0.745, which reflects the country's high life expectancy (76 years), education, and per capita income indicators. Approximately 20.7 percent of parliamentary seats are held by women, and 49.2 percent of adult women have reached at least a secondary level of education compared to 42.1 percent of their male counterparts (Government of Saint Lucia 2019; UNDP 2019d).
Economic	Saint Lucia is an upper-middle income country which has been challenged by relatively low levels of economic growth. Tourism is the main source of economic activity in the country's domestic economy and Saint Lucia's main export earnings are from bananas and manufacturing. The annual GDP growth is 0.60 percent. The GDP per capita is $8,162 and the annual GDP growth rate is 1.7 percent. The overall unemployment rate is 16.8 percent, and the youth unemployment rate is 31.6 percent. Despite the decline in poverty rates over the past years, poverty–especially among children, youth, and female-headed households–remains high. Data from USAID's "Journey to Self-Reliance" project indicate that Saint Lucia's poverty rate ($5/day) is much greater than that of similar nations (World Bank 2020h; Government of Saint Lucia 2019).

INSTITUTIONAL CONTEXT AND LEGAL FRAMEWORK AFFECTING RESILIENCE

The regulatory framework is guided through three main documents: The Disaster Management Act of Saint Lucia 2006, the National Emergency Management Plan, and the National Comprehensive Disaster Management Strategy (Thomas-Louisy 2014). The Disaster Management Act sought to provide a more effective organization for the mitigation of, preparedness for, response to and recovery from emergencies and disasters, and in turn established NEMO. NEMO's role is to develop, test, and implement measures to protect the population from the physical, social, environmental and economic effects of both natural and man-made disasters (Government of Saint Lucia 2020). NEMO's operational concepts are also dictated in the National Emergency Management Plan. NEMO also works closely with CDEMA, and through that collaboration, a country work plan was developed with UN Office for Disaster Risk Reduction. Saint Lucia is one of the first countries to have a functional five-year pathway for resilience.

7 Projections represent the model ensemble median under the high emissions scenario (RCP 8.5) and the range of values in parentheses represent the 10th to 90th percentile.

Other important legal regulations include the Physical Planning and Development Act of 2006, the National Building Codes/Standards and the draft Environmental Impact Assessment (EIA) Regulations. Each of these provide the necessary framework to implement and sustain disaster resilience-related initiatives in Saint Lucia. In keeping with these acts, there are also supporting policies that set out the broad goals and objectives for vulnerability reduction such as the Hazard Mitigation Policy, the Disaster Management Policy Framework, the National Climate Change Policy and Adaptation Plan, the Coastal Zone Management Policy, the National Water Policy, the National Housing Policy, and the National Energy Policy. Saint Lucia's National Adaptation Plan (2018–2028) identifies adaptation measures in cross-sectoral areas and for eight sectors: tourism; water; agriculture; fisheries; infrastructure and spatial planning; natural resource management; education; and health.

A.2 RISK AND RESILIENCE ASSESSMENT

RISK AND RESILIENCE PROFILE

Saint Lucia, like most other Eastern Caribbean countries, is vulnerable to a number of natural hazards, including storms, flooding, landslides, drought, changing climate conditions, earthquakes, and volcanic activity. The following section summarizes the country's priority risks from natural hazards and climate change. The section also characterizes the resilience capacities that are unique to the country.

Priority Risks

Historically, flooding from both localized small-scale flooding and major storm events is a major concern. Flooding is particularly devastating to low-lying areas and coastal villages, which already suffer from socioeconomic inequities and minimal social protection instruments (Government of Saint Lucia and World Bank 2014). In the past, frequently occurring disaster events significantly harmed both the population's socioeconomic well-being and the country's general fiscal stability (Thomas-Louisy 2014). For example, in December 2013, the island experienced extraordinarily heavy rains and suffered severe damages to agricultural farmlands, transportation infrastructure, water networks, and housing infrastructure. The damage assessments of the flood event showed a total loss of $99.88 million, equivalent to 8.3 percent of Saint Lucia's GDP. Six people died, more than 550 were displaced, and approximately 19,984 were directly impacted by the event (Government of Saint Lucia and World Bank 2014). On average, annual losses from flood and wind-related events amount to approximately 3.4 percent of GDP, and a 1 percent annual chance storm is estimated to incur damages of more than 61 percent of GDP (WTO 2019a). Currently with COVID-19, a significant portion of the population are unemployed and are facing increased challenges in preparing for the hurricane season due to lack of financial resources (Stakeholder consultations 2020). Climate change projections suggest that flooding may be exacerbated from more intense precipitation, sea level rise, and storm surge.

Another physical risk is the high potential for landslides. The island's mountainous landscape presents significant engineering challenges for building resilient critical public infrastructure such as roads, bridges, and water supply systems. Landslides can completely cut off many communities. Major landslides also resulted in significant loss of lives and the destruction of homes, displacement of families, and loss of biodiversity (Thomas-Louisy 2014).

With climate change, changes to extreme heat, precipitation conditions, flooding, and sea level rise may exacerbate risks. For example, droughts affect the quantity and quality of available water supplies to local communities and productive sectors of the economy in Saint Lucia, and drought intensity is projected to increase under changing climate conditions. Sea level rise, coastal erosion, and ocean acidification may damage natural resources and coastal infrastructure, posing risks especially to Saint Lucia's tourism industry.

Other natural hazards include earthquakes, volcanic eruption, health pandemic exposure, and sargassum, which contribute to compounding and cascading risks. For example, many people are unemployed due to the COVID-19 pandemic and have increased difficulties in preparing for the hurricane season because they lack the financial resources to prepare.

Resilience Capacity

Institutional capacity:

- Strengths: Saint Lucia passed the Disaster Management Act in 2006 and produced the National Disaster Management Plan in 2007. In 2004, the National Hazard Mitigation Policy was introduced. The Department of Sustainable Development of the Ministry of Education, Innovation, Gender Relations and Sustainable Development and the Caribbean Natural Resources Institute, with support of the OECS Commission, is currently creating an environmental management bill and a new climate change bill. However, existing legal instruments are limited in application and enforcement, in part due to inadequate monitoring for compliance.
- Weaknesses: These management policies focus strongly on disaster preparedness and response, with limited reference to the planning, mitigation, and prevention components of disaster risk reduction. Stakeholder consultations indicated a lack of institutional coordination on disaster risk reduction, including a lack of knowledge of the roles that agencies—beyond NEMO and across the national government—can take on to enhance resilience. Furthermore, there lacks legislation to govern the mandate of the Department for Environmental Management which has a varied work programs such as climate change adaptation, management of the coastal zone and protected areas, and chemicals management.

Knowledge and technical capacity:

- Strengths: There have been several projects aimed at measurably reducing vulnerability to natural hazards and the adverse impacts of climate change in Saint Lucia. For example, the Second Disaster Management Project, and Disaster Vulnerability Reduction Project include physical prevention, mitigation works, emergency preparedness strengthening, and early warning systems (Thomas-Louisy 2014).
- Weaknesses: The country currently lacks the capacity to undertake predictive disaster analysis to define risk scenarios, and most modeling is done externally through CIMH. There are inadequate early warning systems to reduce risks from natural hazards. There are also insufficient incentives offered to trigger and maintain engagement with other key stakeholders in climate adaptation measures. Additionally, stakeholder consultations indicated that they require more locally based support focusing on rapid needs assessments. In the COVID-19 context, there is a need to better train local teams to conduct disaster risk reduction assessments if help cannot be directed to their island during or after the disaster. For example, it is not feasible for search and rescue teams to be in quarantine for 2 weeks before assisting with damage response and recovery.

Human and community capacity:

- Strengths: The NEMO structure includes the National Emergency Operations Centre and 18 District Emergency Operations Centers to support disaster response at the national and district levels (UNISDR DIPECHO Project 2012). Moreover, several community-level Vulnerability and Capacity Assessments have also been coordinated in Saint Lucia. The assessments entailed hazard identification and risk assessment at the community level, and the implementation of hazard mitigation measures (Thomas-Louisy 2014). The projects also consisted of training and capacity development for community-based disaster management organizations, shelter managers, and the staff of the National Meteorological Services.
- Weaknesses: The community-based resilience measures lack a multi-hazard approach required for a more effective, sustainable, and comprehensive disaster resilience. Additionally, there is the absence of mechanisms at the community level to exchange lessons learned on disaster resilience responses. There is also a lack of quantification of contributions from agriculture, fisheries, forests, and water resource management to the Saint Lucia National Development Corporation.

Financial capacity:

- Strengths: The Disaster Risk Management Policy Framework is the first attempt by Saint Lucia to formalize an approach to disaster risk funding. The funding approach encompasses the use of the Emergency Disaster Fund, the Imprest Account of NEMO and the Contingency Fund. The Contingency Fund, however, can only be used for disaster response. As a result, the Government is in the process of making a National Disaster Fund to move away from the Contingency Fund. The proposed National Disaster Fund will be used for preparedness and prevention and is designed to grow every year. The island is also insured through CCRIF SPC for excessive rainfall, earthquakes, and hurricanes. Under the insurance scheme, once a pre-defined disaster magnitude trigger is reached, there is a payout regardless of damage experienced on the island. Stakeholder reports indicate that this insurance process works well and CCRIF SPC is now developing sustainable livelihoods insurance policies for local farmers and fisherfolk. The country can also access loans from CDB and the World Bank for long-term recovery and rebuilding.

Photo by Danial Obert on Unsplash
Brain coral, Saint Lucia

- Weaknesses: Catastrophes resulting from hydrometeorological events present significant fiscal shocks to government budgets that result in budget reallocations and the reduction of public and social services for the country. The fiscal debts also create a dependency on donors to replace or repair damaged capital stock. NEMO has no dedicated fund for short-term relief after a disaster. While the Emergency Disaster Fund should be used for unforeseeable, non-recurrent disasters, the fund is not operational in reality (World Bank 2017) The Contingency Fund is small ($315,000 as of September 2016), is not being replenished, and is not set up to be utilized to finance disaster-related expenditures. Local stakeholders also expressed that long-term resilience planning takes time. In some instances, there is not enough time between emergencies to consider financial capacity. Presently, there is an ongoing project with Monmouth University (Five Islands Situational Awareness for St Kitts, Saint Lucia, Grenada, Dominica) to analyze operational readiness at the national level.

CURRENT STATUS OF THE COUNTRY'S RESILIENCE MEASURES

The table provides a snapshot of illustrative ongoing resilience measures in the country and is not meant to be comprehensive.

Program Name	Entity	Status: Year(s) and Size ($)	Description
Green Schools Nationally Appropriate Mitigation Action (NAMA)	Department of Education with technical support by the Energy Division	2019–2021	Building resilience to climate change through promotion of sustainable energy in Saint Lucian schools.
Measurable Reduction of Disaster Risk Specific to Public Infrastructure	Implementer: various ministries and the National Disaster Management Organization Donor:World Bank	2016–2021 (5 years) $1.3 million	The project initially focused on supporting the government to better understand disaster risk. National priorities include –Enhancing the resiliency of the housing sector. –Fostering knowledge sharing around resilient urban development. –Strengthening resilient social protection systems.
Saint Lucia Disaster Vulnerability Reduction Project	World Bank International Development Association (IDA) and the Strategic Climate Fund Grant	2014–2021 (7 years) $68 million	The project aims to reduce urgent disaster vulnerability and increase long-term climate resilience in Saint Lucia by addressing the multi-faceted risks associated with hydrometeorological events.

SOURCES FOR ADDITIONAL INFORMATION

- Government of Saint Lucia Comprehensive Disaster Management Strategy and Programme Framework.
- Saint Lucia Disaster Management Act.
- Advancing Disaster Risk Finance in Saint Lucia.
- Saint Lucia Third National Communication to the UNFCCC.

GRENADA
A.1 COUNTRY CONTEXT

ENVIRONMENTAL, SOCIAL AND ECONOMIC CONTEXT

Environmental	The country is a tri-island state consisting of the islands of Grenada, Carriacou, and Petit Martinique. The area of the country is 34 000 ha with 121 km of coastline. Grenada's topography ranges from mountainous rainforest to dry lowlands, and coastal mangroves. There were at least five different volcanic centers of activity across the island. The Kick 'Em Jenny submarine volcano is a historically active submarine volcano located 8 km north of Grenada. Grenada and its dependencies are characterized by a humid tropical climate. The historical (1901–2016) mean annual temperature is 26.5°C and historical mean annual precipitation is 1509.1mm. Projections indicate that mean annual temperature will rise by 1.4°C (0.96°C to 2.0°C) by 2050 and annual precipitation will decrease by 50.2 mm (-327.8 mm to 160.6 mm) by 2040 to 2059 (World Bank 2018; World Bank 2020d).[8]
Social	Grenada has a population of 105,539 people. The island's Human Development Index for 2013 places it in the "high development" category with a value of 0.744. The average life expectancy is 72 years. The literacy rate for the 15–24 years cohort is 99.2 percent. The 65 years and older cohort has the lowest literacy rate of 96 percent. The 2008 Poverty Assessment showed that 37.7 percent of the population was living below the poverty line. An additional 14.7 percent was considered vulnerable to falling into poverty. Children (0–14), young adults (15–24) and women, were disproportionately affected by poverty. 39.4 percent of the poor were children and 27 percent of the youth were poor. The unemployment rate is 24 percent of the active population. Forty percent of the unemployed are youths whereas 27 percent are women (Charles 2014).
Economic	The economy of Grenada is based on agriculture (notably nutmeg and mace) and tourism. In 2017, the GDP comprised of: 81.3 percent from services (including tourism), 12.7 percent from industry, and 6.1 percent from agriculture and fishing. More than half of population are directly involved in some kind of agriculture. The reduced income due to high unemployment rates from the COVID-19 pandemic has increased subsistence or backyard farming on the island. Grenada's GDP grew an estimated 3.1 percent in 2019. Data from USAID's "Journey to Self-Reliance" project indicate that Grenada's GDP per capita is greater than that of similar nations (USAID 2020a).

INSTITUTIONAL CONTEXT AND LEGAL FRAMEWORK AFFECTING RESILIENCE

The main legal instrument pertaining to disaster and emergency management in Grenada is the National Disaster (Emergency Powers) Act 1984 which designates authority to declare a State of Emergency. Other laws that provide legislative support for the management of disaster risk resilience and climate change related issues include the Public Health Act 1925, the Quarantine Act 1947, the Mosquito Destruction Act 1952, and the Forest, Soil and Water Conservation Act 1949.

The National Disaster Management Agency (NaDMA) is the lead agency with responsibility for coordinating disaster management and response duties. NaDMA leads the development of the revised National Disaster Management Plan for Grenada, which updates the previous 1985 and 2005 plans. This plan details the national disaster committees' responsibilities and functions for response against hurricanes, earthquakes, volcanic eruption, floods, and landslides. Additionally, a National Hazard Mitigation Policy was developed in 2003 which plan sets the policy context for developing an approach to hazard risk reduction (Charles 2014).

8 Projections represent the model ensemble median under the high emissions scenario (RCP 8.5) and the range of values in parentheses represent the 10th to 90th percentile.

The Ministry of Climate Resilience, the Environment, Forestry, Fisheries, and Disaster Risk Management was established in 2018. The National Climate Change Policy 2017–2021 identifies priority investments for critical infrastructure, land use, and food security. The Policy is implemented through the National Adaptation Plan 2017–2021, which is focused on mainstreaming climate change adaptation activities into national development planning, and the country's NDC.

A.2 RISK AND RESILIENCE ASSESSMENT

RISK AND RESILIENCE PROFILE

As a Caribbean SID, Grenada is susceptible to seismic, hydrological, and meteorological disasters as well as socioeconomic stressors that affect a small island state. This section focuses on priority risks and resilience capacities that are unique to the country.

Priority Risks

Grenada suffered signficant impacts from Hurricanes Ivan and Emily in 2004 and 2005, highlighting some of the country's risks. Hurricane Ivan caused 39 deaths and $900 million in damages, twice Grenada's GDP at that time (Chambers 2017). The hurricane decimated the country's agricultural sector and the tourism sector. The tourism market contracted and job losses in the tourism sector amounted to about 60 percent. Indirect impacts included increase in poverty levels for segments of the population, increase in fuel prices, diminished commercial trade and production, and increased food prices (Finlay 2010). Economic downturns in key source markets after Hurricanes Ivan and Emily led to rising public sector debt and expanding fiscal deficit, which exacerbated impacts from the global economic crisis in 2011–2012 (World Bank 2016).

Additionally, the country is at risk from a range of climate hazards including coastal hazards such as sea level rise, storm surge, coastal erosion, sargassum seaweed, drought, extreme temperatures, and flash flooding from heavy rainfall. In addition to acute hurricanes, chronic coastal hazards such as sea level rise pose risks to the tourism sector, the country's major economic sector. Changes in precipitation and temperature conditions increases risks to the agriculture sector, another key sector that supports livelihoods in Grenada. These changes in hazards triggered the implementation of new emerging crop diseases, and protocols to deal with this issue, including public awareness and research. The country is also at risk from drought, which decreased production in agriculture and forestry and highlights the need for new irrigation systems that cater to these new climate patterns. Natural hazards also pose risks to infrastructure; for example, aged drainage systems can become overloaded and contribute to flooding during heavy rain storms (Gibbs 1998).

Grenada is also at risk from seismic events associated with the undersea volcano Kick 'Em Jenny which has erupted 14 times since 1939 (UWI 2011). Eruption can cause high magnitude earthquakes and major tsunamis. The location and nature of the volcano also highlights the vulnerability of the island's shipping industry to indirect hazards; in the past, the volcano has damaged ships as they traverse to Grenada.

Resilience Capacity

Institutional capacity:

- Strengths: There are multiple policies that speak to disaster management in Grenada, although many are not codified and implemented. For example, the Ministry of Agriculture developed an agriculture disaster management policy to provide an overarching framework for disaster risk management for the sector.

- Weaknesses: The primary gap in the legislative environment is the absence of a comprehensive disaster management law to govern domestic disaster risk management and guide foreign disaster relief. There are also gaps in guidelines to govern the relationships between stakeholders and national committees, and as a result, a gap in coordination and implementation. Additionally, there is a lack of procedures for risk management of less frequent disasters such as landslides, earthquakes, and disease epidemics. While there are many proposed strategies and initiatives, they currently lack the capacity to implement these strategies.

Knowledge and technical capacity:

- Strengths: Grenada's drought management plan details the operating procedures for managing water demand (Government of Grenada 2019). Additionally, in 2007, a real-time monitoring station was installed at the Kick 'Em Jenny submarine volcano.
- Weaknesses: Most communities lack early warning systems to facilitate communication between NaDMA and communities, including farmers (Charles 2014). There is also a lack of capacity at the local meteorological office. Given recent staff retirements, presently, there are only five staff at the office who are stretched beyond their capacity. Furthermore, local stakeholders indicated that more capacity is needed to conduct post-disaster damage assessments on the island to detail the impacts and priority needs following a disaster. Longer-term capacity building is also needed for preparedness and pre-disaster planning.

Human and community capacity:

- Strengths:
  - In response to a large unemployment spike and impacts to the tourism sector due to COVID-19, the government is supporting populations and communities through investments in the agriculture sector. The government provides support through a farm level subsidy and puts areas into farm production. After the devastating damages from Hurricane Ivan, many areas were not re-cultivated. But response to the COVID-19 pandemic created an opportunity to put those areas back into production while reducing unemployment. The government also provided supplies for backyard farming such as soil materials and fertilizer. Thus far, these efforts have had a positive impact.
  - The Grenada Community Development Agency (GRENCODA) is an indigenous non-governmental development agency that supports the development of Grenada's rural communities. After hurricanes, GRENCODA coordinates local relief efforts to rural communities. For example, GRENCODA conducted damage and needs assessments following Hurricane Lenny in 1999 to secure funding from the Canada Fund for Local Initiatives to assist fishermen who lost their equipment and to assist families whose houses were destroyed. GRENCODA is also involved in community education and public awareness of climate-related issues (Jessamy and Turner 2003).
- Weaknesses: Hurricane Ivan and other hurricanes showed that many homes are not insured, with significant implications for families and vulnerable populations. Less than 1 percent of houses in the region were insured against natural disasters (Auret 2003). Over 40 percent of the low-cost houses in the rural communities were deemed to be highly vulnerable to disasters (Jessamy and Turner 2003). Further, it was noted that there is the need for more educational programs on disaster preparedness.

Financial capacity:

- Strengths: Since Hurricane Ivan, the country implemented the Public Finance Management Act no. 27 of 2007, providing for a Contingencies Fund. The Parliament is authorized to appropriate these funds for urgent and unforeseen disaster needs. Following Hurricane Ivan, the Ministry of Finance also introduced the Reconstruction and Development fund, designed to be used for farm and home reconstruction, youth skills, training, and employment following a disaster and is geared toward rebuilding the lives of the poorest and most vulnerable groups in society. Other

disaster-related financing mechanisms include the National Insurance Scheme and the National Transformation Fund. In 2007, Grenada became a member of the CCRIF SPC parametric windstorm and earthquake insurance policy and excess rainfall coverage was added to Grenada's policy in 2014 (World Bank 2018).

- Weaknesses: Though the country is a member of CCRIF SPC's insurance policy, the loss calculated from past rainfall related disasters was below the policy's attachment point and did not trigger a payout. As a result, in 2017, Grenada sought donor assistance to purchase natural hazard insurance at an increased level of coverage to ensure that fiscal policies are not derailed by natural hazards.

CURRENT STATUS OF THE COUNTRY'S RESILIENCE MEASURES

The table provides a snapshot of illustrative ongoing resilience measures in the country and is not meant to be comprehensive.

Program Name	Entity	Status: Year(s) and Size ($)	Description
Grenada Second Fiscal Resilience and Blue Growth Development Policy Credit	World Bank	$20 million	Provides Grenada with contingent financing in case of natural disasters, while supporting the country's reform program to build multi-sectoral resilience to disaster and climate risks.
Climate Resilient Water Sector in Grenada	Ministry of Finance, Planning, Economic Development and Physical Development, GIZ	2018–2025 $49.9 million	Support the water sector by reducing water demand and increasing water availability. Establish a Water Resource Management Unit and create a water tariff for climate-responsive price signals. Infrastructure investments for water capture and storage.
GCF country program	CCCCC, New York University, GIZ	2019–present	Supporting readiness activities for GCF project proposals in the pipeline. Nine projects are in the pre-feasibility stage.

SOURCES FOR ADDITIONAL INFORMATION

- Grenada National Disaster Plan.
- Country Document for Disaster Risk Reduction for Grenada, 2014.
- Grenada Second National Communication to the UNFCCC.

BARBADOS
A.1 COUNTRY CONTEXT

ENVIRONMENTAL, SOCIAL AND ECONOMIC CONTEXT

Environmental	The island of Barbados is bordered by the Caribbean Sea to the west and the Atlantic Ocean to the east. The area of the country is 430 square kilometers with 97 kilometers of coastline. Its terrain is mainly flat with a hilly interior. The climate consists of a wet season from June to November and a dry season from December to May. The island has no major rivers or surface streams, and therefore relies on groundwater as the nation's primary water source. The historical (1901–2016) mean annual temperature is 26°C and historical mean annual precipitation is 2067.8 mm. Projections indicate that mean annual temperature will rise by 1.3°C (0.9°C to 1.97°C) and annual precipitation will decrease by 47.8 mm (-290.1 mm to 153.1 mm) by 2040 to 2059.[9] The island is also subject to sea level rise, increasing storm intensity, earthquakes, landslides, and tsunamis (UNDP 2020a; World Bank 2020b).
Social	Barbados is one of the most populated and prosperous Caribbean nations. The country is among the most densely populated nations in the world with a density of 637 people per km^2. Barbados sits in the high human development category of the UNDP Human Development Index, and mean life expectancy and years of school are high compared to other Caribbean nations. Globally, Barbados has one of the highest literacy rates in the world (98 percent). The country has achieved universal access to education and health services, free access to HIV/AIDS treatment, and almost 100 percent access to clean drinking water and sanitation. Barbados lags behind other nations in the high human development category in regard to gender equality. There is also a high poverty rate among youth (15–24 years) in Barbados (23 percent) compared to individuals over 24 years of age (15 percent). Natural disasters and environmental degradation have been found to impact youth access to adequate healthcare, education, and protection from violence. Barbados also has a considerable aging population (UNDP 2019b; Evanson 2014).
Economic	The majority of the workforce in Barbados is employed by the tourism, government, manufacturing, construction, mining, agriculture, and fishing sectors. Tourism is a significant economic driver in the country. An offshore financial services sector has become the second largest source of financial exchange after tourism. Sugar production was formerly a large contributor to the nation's GDP; however, economic diversification coupled with recent drought and declines in soil fertility have diminished the importance of this crop to the national economy (UNDP 2020a).

INSTITUTIONAL CONTEXT AND LEGAL FRAMEWORK AFFECTING RESILIENCE

Since 2003, Barbados has developed policies, strategies, and legislation aligned with comprehensive disaster management. The Emergency Management Act of 2007 established the Department of Emergency Management. The Department of Emergency Management oversees the country's National Disaster Management Program, which seeks to educate citizens about the various elements of disaster management, create appropriate mechanisms to promote and advance disaster management activities, promote and institutionalize the practice of appropriate preventive and mitigation measures, and promote the development and maintenance of warning, response, and recovery plans for all sectors. The Department developed a 2019–2023 Strategic Plan, which outlines its programs and mechanisms. These

9 Projections represent the model ensemble median under the high emissions scenario (RCP 8.5) and the range of values in parentheses represent the 10th to 90th percentile.

include the National Emergency Management System, a multi-sector mechanism that brings together human resources elements, technical expertise, and other resources to ensure effective readiness and to address disaster risk reduction. The Department also chairs the Emergency Management Advisory Council, established in 2006 by emergency management legislation, which includes public and private sector representation. The Department works heavily with 30 District Emergency Organizations, a community volunteer mechanism and the primary vehicle for organizing preparedness at the local scale. Barbados serves as the Central Sub-Regional Disaster Emergency Response Focal Point for CDEMA which supports emergency response to Dominica, Saint Lucia, and Saint Vincent and the Grenadines (CDEMA 2016).

Barbados created a National Climate Change Policy in 2012. This policy outlines plans to further institutional, administrative, and legislative work in both climate adaptation and mitigation in Barbados. The Green Economy Scoping Study and Coastal Risk Assessment and Management Program, among other programs, were developed to help achieve this goal.

A.2 RISK AND RESILIENCE ASSESSMENT

RISK AND RESILIENCE PROFILE

The most common natural hazards that historically impact Barbados are floods, droughts, and tropical storms. The country also experiences earthquakes, wildfires, landslides, and tsunamis. The following section summarizes the country's priority risks. The section also characterizes the resilience capacities that are unique to the country.

Photo by Cedric Frixon on Unsplash
Sea turtle in the waters of Barbados

Priority Risks

As a small and densely populated nation with a low-lying coastal zone, Barbados is vulnerable to a range of natural hazards. The tourism-dependent economy also presents significant risk to financial stability, in the event of impacts from natural shocks or stressors on the tourism industry.

Barbados experiences flooding caused by both tropical storms/hurricanes and by extreme rainfall during the rainy season. Poor drainage and inadequate storm water infrastructure in many areas result in common flash floods. Intense rainfall and wave action in coastal areas also results in small-scale landslides, particularly in the Scotland District. These landslides result in adverse impacts to agriculture, transportation, and housing infrastructure. Barbados is also particularly vulnerable to hydrological drought because the country has limited above and below ground water storage capacity. Barbados is classified as a water-scarce country and droughts have severe implications for water resources users, including the agriculture and tourism industries. Barbados experiences earthquakes frequently and is ranked in the top 10 countries in the world in terms of probable maximum loss from earthquakes. Wildfires are common during the dry season and pose a risk to human health, crops, property, and water resources. Finally, the country is at risk from changing instances of pests due to climate change, including the introduction of non-native invasive pests.

Resilience Capacity

Institutional capacity:

- Strengths: The enactment of disaster management legislation and the structure of the national disaster management mechanism in Barbados allowed for interdisciplinary, inter-sector partnerships and the mainstreaming of risk management into national planning processes. The National Emergency Management System houses a Vulnerable Persons Committee that has been successful in representing this group in disaster management decision-making.
- Weaknesses: A lack of capacity resulted in weak enforcement of the existing legislative framework. Additionally, the special needs of vulnerable communities in awareness and preparedness, emergency shelter situations, post-disaster recovery, and access to education and employment appear to be overlooked within the policy and planning framework.

Knowledge and technical capacity:

- Strengths: Barbados benefits from having decades of local data that can be used to inform resilience and disaster management planning and programming. The government invested data and information into geographic information system platforms to support decision-making.
- Weaknesses: Fragmentation of data and lack of centralization and integration across agencies presents issues for analysis and planning efforts. Furthermore, databases may be developed, but without sufficient personnel, equipment, or technical skill for maintenance.

Human and community capacity:

- Strengths: The country has heavy regional engagement from volunteers through the Department of Emergency Management's District Emergency Organizations. Barbados designed a disaster drill training course to be used at national and regional levels and designated a group of trainers to conduct the courses.
- Weaknesses: In the public sector, a lack of human resource capacities has resulted in a lack of inter-agency coordination in the areas of environmental management and disaster risk reduction.

Financial capacity:

- Strengths: The Department of Emergency Management and 30 District Emergency Organizations receives budgetary support from the Government of Barbados.
- Weaknesses: Agencies across the government often lack the necessary funding to maintain data collection and management programs effectively.

CURRENT STATUS OF THE COUNTRY'S RESILIENCE MEASURES

The table provides a snapshot of illustrative ongoing resilience measures in the country and is not meant to be comprehensive.

Program Name	Entity	Status: Year(s) and Size ($)	Description
GOVERNMENT			
Roofs to Reef Program (R2RP)	Government of Barbados	2019 $624,527	The R2RP is the Government's sustainable development model for the next decade and represents the country program for Barbados. The primary focus is on improving the social and environmental circumstances of the people in Barbados. The R2RP will enhance the country's ability to recover from climatic events. The R2RP is hinged on six thematic areas: Shelter, Water, Energy, Waste, Land use, and Ecosystems Management
Water Resource Management and Flood Resilience Program	Government of Barbados and USAID	N/A	This project seeks to improve Barbados' water resource management and flood resilience. Activities are split into two phases. The first phase relates to the development of the following studies: (i) An updated Stormwater Management Plan; (ii) Flood Reduction Measures in the Trents/Holetown Area; (iii) Report on the management of the Holetown lagoon; (iv) Stormwater and Groundwater Quality Study; and an (v) Education, Awareness, Outreach and Training program. The second phase involves upgrading drains and culverts to alleviate incidences of frequent flooding in the Holetown and Trents area on the west coast of Barbados
Program Name	**Entity**	**Status: Year(s) and Size ($)**	**Description**
DONOR			
National Coastal Risk Information and Planning Platform (NCRIPP)	IDB	N/A	The NCRIPP study assessed coastal and island-wide hazards in Barbados and developed a software platform to investigate hazards, vulnerability, and risk. The study produced a Coastal Risk Atlas, enterprise-level GIS and GeoDatabase used by the Barbados Government to increase resilience in vulnerable areas.
Water Sector Resilience Nexus for Sustainability in Barbados	Implementer: CCCCC, Government of Barbados Sponsor: GCF	2018–2024	This is the CCCCC's first country project and is designed to strengthen the resilience of Barbados to the impacts of climate change, support adaptation measures in the water sector, and reduce the carbon footprint of the Barbados Water Authority.

SOURCES FOR ADDITIONAL INFORMATION

- Country Document for Disaster Risk Reduction: Barbados, 2014.
- Indicators of Disaster Risk and Risk Management: Barbados.
- Barbados Second National Communication to the UNFCCC.

ANNEX B: ORGANIZATIONS CONSULTED

Academia, Civil Society and Private Sector	
• UWI Mona	**20** 7 Men 13 Women
• UWI Centre for Resource Management and Environmental Studies (CERMES)	
• Caribbean Natural Resource Institute	
• Caribbean Youth Environment Network (Barbados chapter)	
• UWI graduate students in resilience and climate change	
• CRIF SPC	

Donors and Multilateral Development Banks	
• DFID Caribbean	**5** 4 Men 1 Woman
• IDB	
• CDB	
• UNDP	

National Government Entities	
• Antigua and Barbuda Ministry of Health, Wellness, and the Environment	**18** 14 Men 4 Women
• Barbados Ministry of Agriculture and Food Security	
• Barbados Ministry of Environment and Drainage	
• Grenada Ministry of Agriculture	
• Grenada National Disaster Management Agency	
• Guyana Ministry of Agriculture	
• Guyana CDC	
• Saint Lucia NEMO	
• Tobago Emergency Management Agency	
• Trinidad and Tobago Ministry of Planning and Development	
• Trinidad ODPM	

Regional Entities	
• Inter-American Institute for Cooperation on Agriculture	**14** 11 Men 3 Women
• CDEMA	
• CCCCC	
• Organization of Eastern Caribbean States (OECS)	
• CIMH	

USAID and U.S. Government	
• USAID LAC Bureau Regional Sustainable Development Office	**8** 2 Men 6 Women
• USAID Bureau for Resilience and Food Security	
• USAID/Eastern and Southern Caribbean General Development Office (Barbados)	
• USAID/Eastern and Southern Caribbean Program Office (Barbados)	
• USAID Bureau for Humanitarian Affairs	

ANNEX C: HIGH-LEVEL CLIMATE RISK MANAGEMENT MATRIX

1.1: Defined or Anticipated DOs, IRs, or sectors*	1.2: Timeframe*	1.3: Geography	2: Climate Risks*	3: Adaptive Capacity*	5: Opportunities	6.1: Climate Risk Management Options
Enhance Disaster Resilience Systems	0 - 25 years	ESC Region	–Impacts from successive climate hazards compound losses, straining response and recovery efforts and financial resources targeted towards rebuilding. –Cascading impacts of climate hazards on key sectors (e.g., power, water resources) increase community vulnerability to public health impacts (e.g., water borne diseases). –Risks to communities and systems vary in part due to geography and topography. Mountainous countries (e.g., Trinidad and Tobago and Saint Lucia) experience rainfall-induced landslides which cut off communities. Flat terrains (e.g., Antigua and Barbuda) experience pooling of floodwaters.	–The Regional Response Mechanism (RRM) developed by CDEMA, made important progress in coordinating member responses to severe events, but improvements in capacity and coordination are still required. Stakeholders raised concerns about gaps in coordination with relief organizations that are not part of the RRM. –Integration of disaster risk management and climate change adaptation is lacking at all levels of governance. –The fragmented response to the 2017 Hurricanes Maria and Irma across regional institutions, national governments, NGOs, and donors also highlighted the need for improvements to the logistics platform, and for funding mechanisms that are reliable and efficient.	–Proactive disaster risk mitigation and prevention can safeguard lives, promote development, and reduce costs associated with emergency response, damage, and reconstruction; for example, upfront investment in climate proofing of a bridge (Saint Lucia) and a deep-water port (Dominica) were found to be less than reconstruction costs. –Investments in resilience can provide training and employment opportunities for unemployed youth and adults. –Investments in improved multi-hazard early warning systems for communities can benefit other sectors; for example, with additional investment, early warning systems could be targeted to the business community, agriculture, and other sectors.	–Support the transformation and development of a multi-hazard approach that maximizes the effectiveness and efficiency of disaster risk reduction and climate change adaptation programming. –Support the co-design process of a multi-hazard approach that engages a broad range of partners and stakeholders to enhance stakeholder collaboration, buy-in, and interaction in the region. –Support improved information development and dissemination, including multi-hazard, multi-sectoral, and multi-level mapping of natural hazards in ESC countries.

1.1: Defined or Anticipated DOs, IRs, or sectors*	1.2: Timeframe*	1.3: Geography	2: Climate Risks*	3: Adaptive Capacity*	5: Opportunities	6.1: Climate Risk Management Options
Enhance Disaster Resilience Systems	0 - 25 years	ESC Region	–More intense hurricanes with stronger winds and more rain, and associated floods and landslides, increase the severity of damage to assets and infrastructure. ESC's northern islands are at higher risk from hurricanes due to their geographic location. –Agricultural losses and reduced water availability due to drought negatively affect communities by impacting livelihoods and stressing potable water and sanitation systems (these risks are covered under agriculture and water). –Economic growth and progress compromised and difficult to maintain due to climate risks; for example, the CCRIF estimated that Guyana could experience climate-related losses up to 19 percent of GDP in 2030.	–The ability to plan and implement a sustained plan to build resilience over time is hampered by the lack of long-term core funding. International donors' focus on funding relatively short-term projects with specific requirements can hamper institutions' ability to invest strategically in longer-term programs and organizational strengthening. –Disaster risk management agencies, and risk management, are often not well-placed within the government hierarchy, weakening the ability to coordinate and finance cross-sectoral initiatives. –Information on risk and early warning, as well as institutional roles and financial resource availability remain siloed by hazard. For example, Disaster risk management approaches are not designed and organized to confront and address simultaneous, cascading, or consecutive disaster events and other risks that compound community vulnerability, such as the convergence of public health crises and a hurricane (e.g., COVID-19 and Hurricane Laura).		–Promote coordination and information sharing between disaster management and sector agencies and support technical and institutional development to strengthen national capacity to address multiple hazards. –Build National Capacity for Sector Integration. Promote coordination and information sharing between disaster management and sector agencies and support technical and institutional development to strengthen national capacity to address multiple hazards and climate change. –Structural protection to reduce risks through resilient infrastructure.

1.1: Defined or Anticipated DOs, IRs, or sectors*	1.2: Timeframe*	1.3: Geography	2: Climate Risks*	3: Adaptive Capacity*	5: Opportunities	6.1: Climate Risk Management Options
Enhance Disaster Resilience Systems	0 - 25 years	ESC Region	–Port infrastructure is at risk of damage and disruption, which can have severe economic impacts and disrupt disaster response, especially for SIDS. When Hurricane Maria hit Dominica in 2017, a combination of physical damage, limited storage space, and procedural shortcomings created major difficulties managing the surge in container traffic as disaster relief arrived.	–Regional emergency response and relief coordination mechanism is established (e.g., CDEMA); challenge is connecting that to national and local action and implementation. –Caribbean Risk Information System provides risk management data and information; however, data and information availability remains a challenge. –Implementation of Disaster risk management is compromised due to lack of financing, and poor prioritization of actions. –Comprehensive Disaster risk management is promoted at the regional level (expanding from response and recovery towards mitigation and prevention); at the national level, capacity constraints limit focus to response and recovery. –At the country level, Disaster risk management agencies lack critical human and financial resources for executing emergency operations.		–Appropriate land use policies including zoning rules and enforcement. –Strengthen building codes and standards. –Strengthen social safety nets. –Reduce financial risk through introducing risk-financing instruments, such as insurance, microinsurance, bonds, or guarantee programs targeted towards communities. –Support contingency planning, especially with small businesses, with rapid access to financing for recovery.

1.1: Defined or Anticipated DOs, IRs, or sectors*	1.2: Timeframe*	1.3: Geography	2: Climate Risks*	3: Adaptive Capacity*	5: Opportunities	6.1: Climate Risk Management Options
Enhance Disaster Resilience Systems	0 - 25 year	ESC Region		–Transmitting early warning information to communities is challenging due to poor communications infrastructure and limited redundancy to facilitate emergency telecommunication and information sharing. –Local NGOs, such as the Red Cross, support coordination among community-based groups and national disaster agencies, and develop mechanisms to build community resilience and early action; but communities do not always receive information in a timely, actionable manner, and do not have resources to absorb or quickly recover from impacts. –Lack of adequate construction standards and practices increases sensitivity of structures and infrastructure. –Environmental degradation reduces the capacity of natural systems to absorb impacts of severe events and support resilience. –Poor transport infrastructure diminishes capacity for timely disaster response, recovery, and rebuilding.		–Ensure that operational systems to support pre- and post-disaster responses are up to international standards both nationally and regionally. –Strengthen community-level response systems and connections with national systems. –Account for COVID-19 in hurricane response plans. –Integrate non-governmental and private sectors into adaptation processes, including emergency preparation, public health, infrastructure, and the development of economic recovery programs that will ensure that the vulnerable are engaged and protected. –Provide training and build professional capacity at regional and national levels in data collection and management and application of information in national and community-level response systems.

1.1: Defined or Anticipated DOs, IRs, or sectors*	1.2: Timeframe*	1.3: Geography	2: Climate Risks*	3: Adaptive Capacity*	5: Opportunities	6.1: Climate Risk Management Options
Enhance Disaster Resilience Systems	0 - 25 year	ESC Region				–Support youth involvement in DRR and emergency response planning/training. –Maintain portable Emergency Operations Center (EOC in a box).
Sector: Energy	0 - 25 years	ESC Region	–Cross-cutting impacts of disruption of energy services due to storms or intense heat on key economic sectors, including tourism, agriculture, and water. –The high dependence on imported fuel across most of the region exposes many countries to supply chain risks. Hurricanes disrupted supply chains in the past, delaying and/or limiting seaport-based imports. –Energy reserves are located in coastal areas and are at risk to direct damage from tropical storms and surge; and damage to coastal roads can disrupt distribution.	–High cost of energy remains a significant constraint to economic growth and competitiveness and to the efficient delivery of some social services. –Guyana's poor-quality electricity networks result in frequent outages, increasing sensitivity to climate risk. –Guyana recently discovered important oil reserves, but infrastructure for production is in the early stages of development and the country continues to depend on imported oil (Stakeholder consultations 2020).	–Development of renewable energy sources (which will become economically feasible in the Caribbean before they will in regions of the world where thermal generation is less costly), can reduce energy costs, increase energy security and resilience, and meet greenhouse gas reduction goals. –There is a high potential for solar photovoltaic energy. For example, Barbados' flagship climate change resilient R2RP dedicates $1billion (2 percent of GDP) over the next 10 years towards building resilience and moving towards net-zero carbon emissions by 2030. To reduce pressure on land use, 150 household roofs will be fortified for solar PV, which will be complemented by wind investments to provide 750MW of distributed energy resource. –Geothermal energy is also an opportunity in some countries; for example, Dominica could become a regional energy hub, transmitting excess supply produced from geothermal sources to neighboring islands and earning considerable royalties from electricity exports (WTO 2019b).	–Support youth training in renewable energy technology, aligned with National policies and objectives promoting a transition away from brown technologies. –Integrate resilience to natural hazards into the planned USAID LAC energy programming (e.g., siting, storm hardening, and distributed energy systems). –Support countries on their low emissions pathways, by ensuring operations and investments in renewable energy (solar, wind) account for potential climate impacts, including hurricanes.

1.1: Defined or Anticipated DOs, IRs, or sectors*	1.2: Timeframe*	1.3: Geography	2: Climate Risks*	3: Adaptive Capacity*	5: Opportunities	6.1: Climate Risk Management Options
Sector: Energy	0 - 25 years	ESC Region	–Investments in renewable energy, such as proposed roof top solar, face climate risks; Hurricane Maria damaged nearly all roofs on Dominica. –Trinidad and Tobago faces reduced availability for water cooling systems at energy generation plants due to reduced water availability from drought, variable precipitation, and potential damage to water infrastructure.	–Poor energy efficiency in buildings, appliances, and industrial processes increases demand and costs of power. –Inadequate development of low-cost indigenous sources like solar, hydropower, and geothermal generation increases dependence on imported fuels. –Limited funding for renewable energy projects, limited private sector interest in financing projects, low commercial bank interest in financing projects, or limited availability of appropriate terms for project financing. –Legal and regulatory barriers—continued dependence on outdated frameworks that favor traditional fossil fuel over sustainable energy technology. –Information barriers—limited information about sustainable energy options, causing energy consumers and governments to continue with the status quo. –Market barriers—limited human capital, poor market access to sustainable energy equipment, lack of knowledge about different levels of product quality.	–Newer and more resilient energy infrastructure can help enhance dissemination of early warnings. –Development partners contributed $412,070,445 to the programmatic focus of sustainable energy (Barraza 2020). –The Green Barbuda Project, an NDC Partnership with interest from the Government of Germany and the U.S. National Renewable Energy Laboratory, is focusing on a climate-resilient physical development plan for a 100 percent renewable Barbuda as well as GIS data collection, digitization, and analysis to inform planning and inform climate-resilient investment. –Learn from U.S. investments in energy resilience in Puerto Rico, including storm hardening of transmission and distribution, and solar power.	–Build the capacity of energy institutions and their staff to incorporate hazard and climate change risk information into planning and operational decisions. –Build sustainable and equitable economic independence to increase resilience. Support integration of resilience to natural hazards into emerging national priorities for energy and greenhouse gas emission reductions. –Increase reliability and resilience by introducing renewable distributed energy resources and microgrids. Promote clean energy investments (financing: concessional loans, risk sharing measures; legal and regulatory, etc.) –Coordinate development of national-level integrated resource and resilience plans across the region. –Invest in smart grid and grid-scale storage.

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Sector: Energy	0 - 25 years	ESC Region		–Under COVID-19, power disruptions disproportionately affect education and training opportunities targeted towards youth who may already have poor internet and power connectivity. –The CCRIF Policy rolled out a new policy designed for power utilities, focused on damage to transmission and distribution lines due to storms.		–Relocate or site critical and high-value infrastructure with high vulnerability to lower risk areas. –Install flood barriers to protect critical assets in flood-prone areas. Increase drainage capacity for low areas. –Acquire an asset management database that will be capable of integrating information on climate change vulnerability to inform investment decisions. –Develop system redundancies. Consider where investment in redundancy would benefit resilience (e.g., transmission lines, distributed resources). –Diversify power generation portfolio. –Implement Time of Day metering and differential pricing for energy efficiency. –Incorporate climate change considerations into energy infrastructure design and siting. –Promote hands-on training and certifications for RE installation, inspection, permitting and approval processes for renewables (especially solar).

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Sector: Agriculture and Fisheries	0 - 25 years	ESC Region	–Reduced agricultural productivity due to multiple stressors: stronger storms and hurricanes that increase flooding, erosion, and landslides; more frequent and intense drought; increasingly variable rainfall; sea level rise and saltwater intrusion; and rising temperatures. –Water scarcity impacts rainfed agriculture productivity in many of the small island countries, especially Barbados, Trinidad, and Grenada. –Guyana's low-lying coastal agricultural areas (approximately 6 feet below sea level) face persistent flooding, requiring significant resources to manage drainage and irrigation systems. –Unseasonal rainfall can cause breaches and overtopping of irrigation infrastructure in Guyana, and low water levels can produce tension cracks that can develop into major breaches. –Grenada is experiencing new emerging diseases affecting crops associated with a warming climate.	–CARDI and IICA's provide support to technical development in climate-smart agriculture. –Community-level rainwater catchment systems are growing in popularity on most islands. –The CCRIF Policy provides liquidity to help member countries respond to disasters, including supporting farmers and fisherfolk hit by drought and tropical cyclones. –Farms are small and fragmented, industrial farming has become less profitable, agricultural labor costs are high, agricultural populations are aging, and traditionally grown crops lack diversity. –Agricultural inputs such as water, electricity, and fertilizer, tend to be quite costly, lowering the competitiveness of local products with imports developed in larger economies of scale.	–Participation in carbon markets in Grenada (e.g., plantation-based agriculture) could increase income from agriculture, which could be used to incentivize climate-smart agriculture. –Increases in temperature could lengthen the growing season. –Renewed interested in agriculture from youth provides an opportunity for supporting sustainable agriculture livelihoods, including the use of new technologies and processing.	–Build sustainable and equitable economic independence to increase resilience. Support integration of resilience to natural hazards into emerging national priorities for food security. –Provide training and technical support to expand use of climate-smart agricultural practices (see CCKP fact sheet for Grenadine for examples) –Promote drought and heat-resilient crops and varieties in affected areas to increase resilience to drought, changes in seasonality, and diseases. –Provide training and capacity building to young entrepreneurs in climate-smart agriculture and crop selection techniques, marketing, and agro-processing. –Restore landscapes and protect watersheds; mobilize youth workers as appropriate to support youth employment.

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Sector: Agriculture and Fisheries	0 - 25 years	ESC Region	–Higher temperatures and changes in rainfall patterns require irrigation to be installed in places where it used to not be required. –The 2017 hurricanes destroyed almost all crops on the affected small islands, requiring re-planting for the season; heavy rains and flooding can lead to soil erosion, nutrient leaching, damage to farm equipment, storage, processing facilities and roads. –More intense rainfall and wind events could increase the frequency and extent of crop failure, soil erosion, and nutrient leaching. –Storm, flood, and landslides damage crops, livestock, and agricultural value chain infrastructure. –Increasing severity of drought as a consequence of climate change will impact agricultural productivity; agriculture may face annual losses of GDP for countries particularly dependent on the sector, such as Guyana.	–USAID developed the CCRIF fisheries in selected states to enable them to recover quickly after weather-related events. –Innovations occurred in response to COVID-19 and loss of income, including in hydroponics and aquaponics, new local products, and processing.		–Develop and provide access to integrated decision support systems for weather, agronomic, and market information. –Expand use of early warning systems, weather forecasts, and seasonal climate outlooks for earlier/delayed onset of growing season. –Expand use of seasonal climate outlooks to identify and prepare for changes in climate classification with El Niño and La Niña years, and associated changes in crop suitability and appropriate varietals. –Provide training and capacity building to small and medium enterprises and commercial farmers to use weather, early warning systems, and other decision support information to increase production and reduce crop loss and damage. –Implement early warning awareness and action support, by linking to nationally authorized entities' early warnings, and implementing early protective actions ahead of extreme events.

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Sector: Agriculture and Fisheries	0 - 25 years	ESC Region	–Guyana and Barbados face threats to marine biodiversity from overfishing (Velasco 2014). –In Saint Lucia, near-shore fisheries and coral reefs experience losses due to high levels of sedimentation and other land-based pollutants, as the steep topography, seasonal high rainfall, and unplanned human settlement and development along the coastlines lead to erosion and flushing of pollutants into the bordering coastal ecosystems (Thomas-Louisy 2014). –The presence of sargassum seaweed is a recent costly nuisance for many small island states, though the relationship to a warming climate is not confirmed. Sargassum is harmful to some fish species and corals, depletes fish stocks, and leads to reef death, which reduces coastal protection and leads to coastal erosion.			–Support recruitment and training of young entrepreneurs in climate-smart agriculture, agricultural processing, and market development for agricultural products. –Support applied research on impacts of climate change on key crops and fisheries, and in climate-resilient agriculture techniques. –Support expanded development and delivery of education and training in climate-smart agriculture through extension programs and demonstration farms.

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Sector: Agriculture and Fisheries	0 - 25 years	ESC Region	–Floods and hurricanes caused losses in the fisheries sector in Barbados and Grenada. In 2004, Hurricane Ivan caused $20.3 million in damage and in 2005, Hurricane Emily caused $13.1 million in damage to the agricultural sector (including fisheries) in Grenada (Charles 2014). –In the region, tropical fish are already moving poleward, and coral reefs are bleaching as a result of warmer ocean temperatures (USAID 2018a). –Coral bleaching causes death and shrinkage of coral reefs around the islands. These reefs serve as critical habitats supporting the region's fisheries, including high-value catch species such as spiny lobster and conch. –Mangroves, another critical habitat for marine life, are threatened by sea level rise and deforestation. –Ocean acidification endangers shellfish that are important to local fisheries economically and as a food source.			–Support education on sustainable fisheries and marine-based livelihoods.

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Sector: Agriculture and Fisheries	0 - 25 years	ESC Region	–Shifts in temperature and precipitation patterns can make current soil-based agricultural crops, livestock species, and fisheries less viable in the future as growing seasons change and agriculture and habitat climate suitability zones shift. –Overall, these impacts decrease already low food security in the region and threaten livelihoods that are dependent on agriculture and fisheries.			
Sector: Water	0 - 25 years	ESC Region; focus on Antigua and Barbuda, Barbados, Trinidad and Tobago, Saint Lucia, and Guyana	–Water quality is impacted by issues such as saltwater intrusion, poor sanitation infrastructure, and pollution; water quantity is impacted by groundwater extraction and increased urbanization, which expands impervious surface area and reduces the capacity for groundwater recharge. –As the frequency and intensity of storms increase with climate change, water and sanitation infrastructure damage will become more common. –Increased frequency and intensity of storms as well as more variable precipitation will also affect water quantity and quality: flushing pollutants and debris into water supplies and damaging water infrastructure.	–Barbados has no major rivers or surface streams and is particularly vulnerable to water scarcity. –Antigua and Barbuda relies primarily on desalination for potable water, as well as groundwater, yet experiences daily deficits. –Limited reservoir storage.	–The need for investments in new or renovated infrastructure could provide opportunities to expand services to rural communities and provide jobs to women, youth, and other underemployed groups. –As desalination technology improves, there are opportunities for employment in research, installation, maintenance, etc. –Net zero objectives raise the profile of renewable powered water supply operations.	–Build sustainable and equitable economic independence to increase resilience. Support integration of resilience to natural hazards into emerging national priorities for water security and greenhouse gas emission reductions. –Reduce leakages. –Develop public awareness campaigns to improve water conservation and awareness of the need to protect water resources.

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Sector: Water	0 - 25 years	ESC Region; focus on Antigua and Barbuda, Barbados, Trinidad and Tobago, Saint Lucia, and Guyana	–Projected increases in severe storms and hurricanes may also lead to intensified floods and landslides, contaminating freshwater resources and overwhelming water infrastructure and catchment systems. –Most ESC nations expect further reductions in annual rainfall in the coming years and greater periods of drought affecting water availability. –Barbados and Guyana experience saltwater intrusion due to lower rainfall, over-extraction of groundwater, and sea level rise; exacerbating saltwater intrusion. In Guyana, projected sea level rise and subsequent saltwater intrusion threatens the nation's high dependence on coastal aquifers. –In Trinidad and Tobago, rapid urbanization resulted in insufficient drainage infrastructure and an increase in impermeable land surfaces, resulting in stormwater running off rather than being absorbed into groundwater aquifers.	–In some cases, negative water balances— groundwater and freshwater abstraction—rates are greater than 100 percent. –There is a lack of flexibility in small island states with limited water resources, changes in abstraction rates must be carefully monitored to maintain the water balance, and contamination of water resources can be irreversible.		–Isolate potential outages by introducing renewable distributed energy resources and microgrids (water-energy nexus). –Improve water services to prevent diarrheal diseases: increase chlorination of municipal water supplies; rehabilitate water distribution networks and water treatment stations. –Identify opportunities to engage youth, provide training, and expand employment opportunities in water-related services, such as water management technologies, construction and maintenance of water utilities, community education about water conservation, etc. –Support technical training and capacity building in climate-resilient water resource management.

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Sector: Water	0 - 25 years	ESC Region; focus on Antigua and Barbuda, Barbados, Trinidad and Tobago, Saint Lucia, and Guyana	–ESC countries also experience adverse impacts to water resources due to drought. Previous droughts resulted in water rationing in Guyana and measures to charge farmers for water extraction from certain rivers in Trinidad and Tobago. In Saint Lucia, the government declared a water emergency in May 2020 due to severe drought conditions and low water levels in the island's sole reservoir (Peter 2020). –Storms can cause outages in the electric network by damaging generation, transmission, and distribution infrastructure. Because water distribution infrastructure relies on electricity (e.g., pump stations), a widespread outage can affect water availability.			–Support resilience to extreme storm events and drought conditions by utilizing cleaner energy sources, decentralizing water storage, promote rainwater harvesting at the household and community level, and improve the efficiency with which rainwater runoff replenish aquifers. –Support rehabilitation of deteriorated wastewater treatment facilities, and leaking water supply infrastructure, modernization of water supply and sewerage systems, reducing water losses in networks, improved energy efficiency, and an improvement in wastewater treatment operations. –Improve operations and maintenance of public services such as water and sanitation, drainage, and solid waste collection and disposal.
Sector: Tourism	0 - 25 years	ESC Region, ESC Island States in particular	–Tourism dependent economies, built on the premise of biodiversity richness and health, and functional infrastructure services (e.g., power, water, information and communications technology), are highly sensitive to natural disasters.	–Limited, weak, or absent standards and codes to inform infrastructure, siting, facility and building design and construction	–Recovery from the COVID-19 pandemic provides an opportunity for a transition to more inclusive and sustainable economies, while building resilience to natural hazards.	–Develop backup power generation systems and implement energy efficiency measures.

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Sector: Tourism	0 - 25 years	ESC Region, ESC Island States in particular	–Coastally located hotels, roads and other tourism-supporting infrastructure are vulnerable to damage from more severe storms and hurricanes, and sea level rise and storm surge and accelerated coastal erosion. When Hurricanes Luis and Marilyn struck Antigua and Barbuda in 1995, nearly all tourist resorts were damaged, tourist arrivals fell by 17 percent, and 7,000 people were left unemployed (UCS 2011). –The natural resources (e.g., coral reefs, fish diversity) and coastal beaches that normally attract tourists to the Eastern and Southern Caribbean region face threats from natural hazards (see the discussion on biodiversity). Tobago's largest coral reef, Buccoo Reef, is a key driver of tourism to the country and is already damaged by coral bleaching (Hutchinson-Jafar 2011). –By the end of the century, Antigua and Barbuda is projected to experience a shoreline retreat of about 40 meters, a loss that would severely affect 9 percent of major resorts on the islands.	–Building codes are not legally binding or adequately enforced –Mangrove degradation –Lack of land use planning and/or enforcement leads to construction in low lying, high risk, coastal areas.	–Growth in ecotourism can promote resilient natural systems , provide employment and development opportunities. –High levels of citizen pride, awareness of importance of the blue economy can motivate citizen action to protect natural resources.	–Implement building codes and standards for new infrastructure and facilities, including transportation networks, public services, and tourism facilities. –Create boundaries and buffer zones to protect buildings and coastal infrastructure from sand encroachment, sea level rise, storm surge, and other coastal hazards. –Provide capacity building and training to local decision makers and businesses to improve understanding of climate impacts on biodiversity, infrastructure services and development; help prepare for and cope with stressors and build longer-term resilience by integrating climate considerations into planning and investment.

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Sector: Tourism	0 - 25 years	ESC Region, ESC Island States in particular	–Over 90 percent of the approximately 6,000 hotel rooms in Barbados are built on the coast, less than half a mile from the high-water mark and less than 20m above mean sea level. Storm surge models suggest that currently, over 50 percent of total rooms may be vulnerable in the event of a Category 3 hurricane, representing about $330-550 million to replace (ECLAC 2011). –In Grenada, 1m of sea level rise by the end-of-century (Strauss and Kulp 2018) could affect 73 percent of major resorts along the coastline and 40 percent of seaport lands (Government of Grenada 2017). –Hurricane Irma (2017, Category 5, eye of the storm through Barbuda) and Hurricane Maria (2017, Category 5) caused an estimated $136.1 million in destroyed physical assets in Antigua and Barbuda, 44 percent of which was in the tourism sector. –In Saint Lucia alone, the total estimated cost of climate change impacts on tourism—which include reduced visits, land loss, and damage to coral reefs—is estimated to be between $7.9-12.1 billion by 2050, or 3.6-12 times the nation's 2009 GDP.	–Lack of education and awareness of climate change impacts to biodiversity health and ecosystems.		–Investigate reef restoration and promote sound reef conservation and management to protect reefs in order to reduce coastal erosion and storm surge damage. –Remove, restrict and redesign aging coastal protection structures that are less effective as they deteriorate with age or as their design elevations are exceeded. –Develop alternative transportation routes through less exposed areas. –Promote adequate insurance coverage and disaster contingency funds. –Improve disaster response training for tourist facilities, including performing regular disaster drills.

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Sector: Biodiversity, Environment and Natural Resource Management	0 - 25 years	ESC Region	–High sea surface temperatures and intense storms negatively impact coastal ecosystems, which lead to mass coral bleaching, increased incidences of coral and other invertebrate diseases, and greater physical destruction of the essential habitats of fish and shellfish (Oxenford and Monnereau 2017). –Increased sea temperatures and damages from hurricanes are changing the composition of the foundational reef species, the decline in live coral cover and complexity, and in the loss of mangrove and seagrass habitat. –Destruction of coral reefs and removal of mangroves, which help to attenuate flood wave energy and reduce erosion, lead to an increase in erosion in Grenada (Reguero et al. 2018; Ferrario, et al. 2014). –Irma, Maria, and other hurricanes and tropical storms severely damaged or destroyed ecosystems and their associated services (USAID 2018a). For example, seagrass beds and mangrove forests, which so many species rely on, were ripped apart in Dominica during Hurricane Maria in 2017.	–Limited policy guidance, weak legislation, or lack of enforcement of legislation. –Varying and in some cases, limited education and awareness of the impacts of natural and anthropogenic hazards. –Ongoing chronic degradation of habitats due to pollution, physical destruction from coastal and marine construction, and chronic fish over-harvesting.	–Investments in resilience of environmental and biological systems have resilience co-benefits on infrastructural and human systems. –Forest (both mangrove and land-based) protection efforts contribute to carbon sequestration.	–Encourage ecotourism to attach monetary incentive to preserving ecosystems and wildlife. –Investigate reef restoration. –Protect and restore natural shorelines to protect against erosion. –Improve health of coastal ecosystems, such as mangrove forests and seagrasses, to mitigate erosion.

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Sector: Biodiversity, Environment and Natural Resource Management	0 - 25 years	ESC Region	–Terrestrial ecosystems are also impacted by climate change. Rising sea levels and increased storm intensity is projected to lead to loss of coastlines and beaches in most countries. –The ESC region experienced severe drought from 2013-2016, which can dry out vegetation and increase the likelihood of fires (FAO 2016a, b). –Increased drought, altered rainfall patterns, and rising sea levels will degrade estuaries, inundate lowlands, displace wetlands, and alter tidal patterns in rivers and bays (U.S. EPA n.d.) –Impacts to biodiversity and natural resources in the region can impact human populations via threatening livelihoods that depend on forests, fisheries, and tourism; loss of culturally important landscapes; and loss of subsistence materials (food, wood fuel, and medicines).			–Reduce sediment in runoff by mitigating erosion through reforestation and improved agricultural practices. –Prevent human-induced reef damage (e.g., harmful fishing practices) to prevent additional damage to reef ecosystems. –Develop natural capital valuation into public accounting, so that the costs, benefits (including resilience co-benefits) of investments in green infrastructure can be properly accounted for in feasibility assessments. –Support opportunities to promote payment for ecosystem services. –Support community livelihoods and opportunities for youth that promote environmental sustainability and stewardship. –Integrate hazard and climate projections into natural resource management planning and investment.

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Sector: Youth, Community, and Social Services	0 - 25 years	ESC Region	–Risks to communities and systems vary in part due to geography and topography. Mountainous countries (e.g., Trinidad and Tobago and Saint Lucia) experience rainfall-induced landslides which cut off communities. Flat terrains (e.g., Antigua and Barbuda) experience pooling of floodwaters. –Human settlements and infrastructure are concentrated in coastal zones, which are most exposed to strong winds, flooding, and erosion from storms and sea level rise; home to some of the poorest and most marginalized communities as well as to the critical infrastructure that supports communities and business. –High density, informal settlements are often located in hazard prone areas (e.g., coastal flooding and landslides), where lack of land tenure can lead to poorly constructed housing. Youth are particularly at risk to hazard impacts due in part to their limited voice and empowerment, lack of access to resources, and high unemployment.	–Community capacity building and local community resilience efforts are under-resourced relative to donor funding at the regional level. –Rising unemployment and inequality are eroding the ability of communities to cope with hazard impacts. –Transmitting early warning information to communities is challenging due to poor communications infrastructure and limited redundancy to facilitate emergency telecommunication and information sharing. –Caribbean people are moving toward and into hazard-prone, unplanned, and informal areas at an increasing rate, increasing population at high risk.	–COVID demonstrated, and stakeholders highlighted, the unlimited potential of youth to contribute to disaster preparedness and response, and to become technologically savvy future leaders and entrepreneurs. Youth are an essential cornerstone to community and national resilience. –Strong social dynamics and healthy, functioning ecosystems are critical to adaptive capacity–increasing a community's and region's ability to respond effectively to both chronic stresses and extreme events. –Investments in resilience can provide training and employment opportunities for unemployed youth and adults. –Investments in improved early warning systems for communities can benefit other sectors; for example, with additional investment, early warning systems could be targeted to the business community, agriculture, and other sectors.	–Support local capacity building and community-level resilient livelihoods, including nature-based solutions. –Empower youth. Engage and invest in youth, providing targeted support that enhances citizen and economic security and resilience, promoting new opportunities in blue-green livelihoods that promote energy and food security. –Strengthen social safety nets. –Support contingency planning, especially with small businesses, with rapid access to financing for recovery.

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Sector: Youth, Community, and Social Services	0 - 25 years	ESC Region	–Young children also face increased vulnerability to natural hazards, including displacement, disruption to schooling, susceptibility to water and vector-borne disease, and heat stress. Many health impacts (e.g., vector-borne diseases, heat stress) are projected to increase under a warming climate. –Agricultural losses and reduced water availability due to drought negatively affect communities by impacting livelihoods and stressing potable water and sanitation systems (these risks are covered under agriculture and water). –Critical infrastructure (e.g., water supply and sewer systems, transportation networks, education facilities, health services, and energy structures) is also vulnerable to tropical storms, hurricanes, and seismic events. Hurricane Ivan devastated Grenada's built environment, damaging 70 percent of the tourism infrastructure and more than 80 percent of the public and commercial buildings. Grenada's indirect losses from Hurricane Emily in 2005, such as revenue declines from business interruption, supply chain impacts, and temporary unemployment, amounted to $7 million.	–Lack of adequate construction standards and practices increases sensitivity of structures and infrastructure. A significant proportion of families in the region do not have the means to 'hurricane-proof' their homes or invest in other preparedness and resiliency measures. –Small communities in more remote mountainous areas can be cut off by landslides, as reported in Saint Lucia. –Local NGOs, such as the Red Cross, support coordination among community-based groups and national disaster agencies, and develop mechanisms to build community resilience and early action; but communities do not always receive information in a timely, actionable manner, and do not have resources to absorb or quickly recover from impacts.		–Strengthen community-level response systems and connections with national systems. –Account for COVID-19 in hurricane response plans. –Build public awareness and personal responsibility through education and community mobilization efforts.

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Sector: Youth, Community, and Social Services	0 - 25 years	ESC Region	–Increased heat waves can heighten the risk for heat illness and even heat-induced death (USAID 2018a). Increased temperatures can also increase the rate of wear and tear of built infrastructure and equipment, leading to more funds needed for maintenance and repair of both public and private investments and decrease the serviceability of facilities. Increased temperatures also increase the demand for air conditioning, which can heighten the burden of energy costs for low-income families. –Cascading impacts of climate hazards on key sectors (e.g., power, water resources) increase community vulnerability to public health impacts (e.g., water borne diseases).			–Improve operations and maintenance of public services such as water and sanitation, drainage, and solid waste collection and disposal. –Integrate non-governmental and private sectors into adaptation processes, including emergency preparation, public health, infrastructure, and the development of economic recovery programs that will ensure that the vulnerable are engaged and protected. –Build youth capacity, provide technical training, and promote employment opportunities in community-level disaster response and recovery and community outreach. –Strengthen community education and awareness programs, developing curricula at all levels of the education system, and integrating disaster awareness programs into community activities. –Build public awareness by improving transmission and implementation of national policies at grass-roots levels. –Engage youth and women in the co-development of multi-hazard capacity, to inform strategies and provide opportunities for community leadership.

1.1: Defined or Anticipated DOs, IRs, or sectors*	1.2: Timeframe*	1.3: Geography	2: Climate Risks*	3: Adaptive Capacity*	5: Opportunities	6.1: Climate Risk Management Options
Sector: Education	0 - 25 years	ESC Region	–Schools are vulnerable to natural hazard impacts such as flooding and hurricanes. For example, Hurricane Ivan devastated Grenada's built environment, damaging more than 80 percent of the public and commercial buildings. –Interrupted education due to damaged and/or unsafe schools due to structural damage of school facilities caused by storms with heavy winds such as hurricanes. –Interrupted delivery of infrastructure services (e.g., supply of drinking water, power) due to damage to water supply and sanitation or power infrastructure caused by flooding. –Increased risk of climate-related disasters can exacerbate existing inequalities experienced by marginalized populations (e.g., increased vulnerability of women and children to sexual violence and abuse during and after disasters). –Reduced ability of students to learn effectively due to extreme heat. –Potential for an increase in mosquito borne diseases and impacts on children and youth ability to learn due to changes in climate.	–COVID-19 showcased the vulnerability of school children when they do not have access to in-person schooling. Schools' closures also entailed the interruption of access to school feeding, health, water, sanitation, hygiene, and psychosocial support. Since the outbreak, more than 80 million children have stopped receiving hot meals across the region (UNICEF 2019). –Limited opportunities for new graduates in Disaster risk management, due to lack of public investment and prioritization. –Safe School's Program (UN)	–Improving curricula to teach students about disaster and climate change impacts, and related response and resilience measures, can help the population better understand linkages between climate change, their surroundings, and their livelihoods; as well as increase preparedness. –COVID-19 highlighted the need to close the digital divide for students and equip teachers to prepare for remote teaching—these advancements will be useful in managing future climate-related (e.g., hurricanes) and other disasters	–Support youth training in renewable energy technology, aligned with national policies and objectives promoting a transition away from brown technologies. –Support transition to digital, virtual learning platforms, as spurred by the realities of COVID-19: including investments in promoting a digital society, to expand reach of training and knowledge; ensure digital infrastructure investments account for and are resilient to natural hazards. –Raise youth awareness of DRR and climate change adaptation as well as blue-green livelihood opportunities by integrating them into formal primary, secondary, and tertiary school curricula and training primary and secondary school teachers to teach them. –Build on ongoing government efforts and private sector (e.g., CCRIF) efforts that focus on youth through funding of interns, training, and educational opportunities.

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