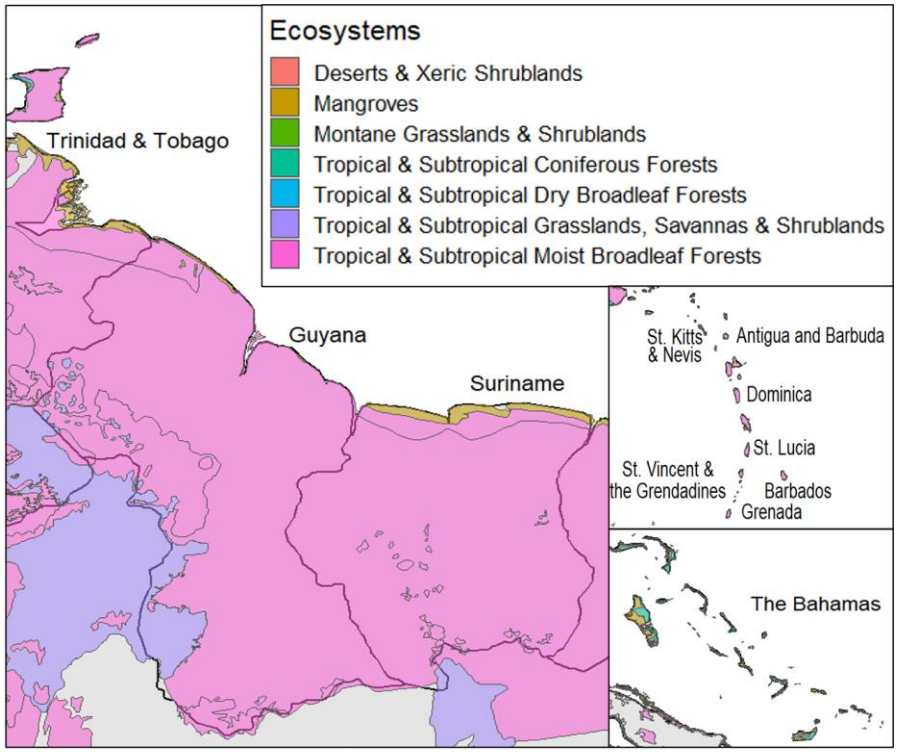
AUGUST 2021 FACT SHEET

CLIMATE RISK PROFILE
EASTERN AND SOUTHERN CARIBBEAN

REGION OVERVIEW

Ecosystems in the Eastern and Southern Caribbean



Source: https://www.worldwildlife.org/pages/conservation-science-data-and-tools

USAID's development assistance in the Eastern and Southern Caribbean (ESC) region extends to 11 countries: Antigua and Barbuda, The Bahamas, Barbados, Dominica, Grenada, Guyana, St. Kitts and Nevis, St. Lucia, St. Vincent and the Grenadines, Suriname, and Trinidad and Tobago. The high vulnerability to, and potential for, climate impacts throughout the region often drive direct integration of climate risk management into the country and regional planning processes. For most Caribbean countries, tourism is the largest industry, though Guyana's, Suriname's and Trinidad and Tobago's tourism amounts to less than 5 percent of total exports [1]. Despite varied topography throughout the region, with some islands small and flat and others mountainous, the countries share many climate vulnerabilities and risks [2]. Population and critical infrastructure are typically in coastal areas, facing increased risk from tropical storms, coastal flooding, and sea-level rise [3]. The surface and groundwater quantity and quality may be compromised by changing rainfall patterns and sea-level rise, as was experienced in the Caribbean in mid-2020 [4] with a prolonged drought. Ocean warming and acidification threaten coastal ecosystems, such as coral reefs and mangroves [5]. The smaller island countries are most vulnerable to sea-level rise and saltwater intrusion. The region's islands are frequently affected by hurricanes and tropical storms, which run from June to November, with significant hurricanes and tropical storms hitting the area in recent years. Hurricane Irma damaged or destroyed 95 percent of properties in Barbuda. In Dominica, Hurricane Maria caused 31 deaths in November 2017 and led to about $1.37 billion in damages and losses (226 percent of GDP), including widespread water and power loss. Hurricane Dorian hit the Bahamas in September 2019, setting a record as one of the strongest Atlantic storms ever recorded, with 185 mph winds and stronger gusts [6], causing around $3.4 billion in damages, one-quarter of the Bahamas' GDP [7].

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CLIMATE PROJECTIONS [8]

Increased Temperature

0.86°C-1.50°C (about 1.5°F-2.7 °F) increase in mean temperatures by 2050

Increased Hurricane Intensity

Increase in hurricane intensity, including stronger winds by 2-11% and more precipitation

Rising Sea Levels

Rising sea levels and increased incidence of storm surge

KEY CLIMATE IMPACTS [9]

Coastal Resources

Damaged infrastructure
Decreased access to services

Health

Shifting infectious disease burden
Increased heat stress
Lack of access to health services

Water Resources

Decreased water quantity and quality
Infrastructure damage due to increased storm intensity at sea

Tourism

Degraded coastal ecosystems
Damaged infrastructure
Increased difficulty delivering services

Fisheries

Habitat degradation and loss
Biodiversity loss
Changing fish migration patterns

Agriculture

Crop loss or failure
Loss of land and water resources for irrigation

CLIMATE SUMMARY

The region's topography varies from low-lying coral islands like Barbuda, with a maximum elevation of 42 meters (m) (137.8 feet (ft)) [10], to volcanic islands with mountainous interiors like St. Kitts and Dominica, with maximum elevations of 1,156 m (3,792.7 ft) and 1,447 m (4,747.4 ft) [12], respectively [11]. On the South American mainland, Guyana and Suriname are covered in wetlands, mountains, savannah, and rich tropical forests. The average annual precipitation throughout the

region is 1,855 millimeters (mm) (73 inches (in)) or more but varies widely. For example, the average in Guyana was about 2,387 mm (94 in) in 2017, while Antigua and Barbuda averaged 1,030 mm (40.6 in) annually [13]. Guyana has a humid climate and two wet seasons: the primary from May to July and another lesser rainy season from November to January [14]. Suriname has a tropical climate. The populated north has four seasons: a minor rain season from early December to early February, dry season from early February to late April, a major rainy season from late April to mid-August, and a major dry season from mid-August to early December [15]. Caribbean island nations have a tropical climate with one rainy season, which typically lasts from June to November. The average temperature in the region is around 26°C (about 79°F). Dominica has the coldest average temperature in the region, at 22°C (about 72°F)[16].

CLIMATE [17]

CLIMATE TRENDS

Average annual temperatures have increased 0.2°C-0.7°C (about 0.36°F-1.26°F), varying	Mean Caribbean sea level rise trends are similar to global trends, although the rate of rise across the region varies.
Changes to average annual rainfall vary within the region.	Increase in the number of intense hurricanes.

SECTOR IMPACTS AND VULNERABILITIES

AGRICULTURE

Agriculture is a critical component of the economy for many Caribbean countries. In Guyana, the value-added of agriculture as a percentage of GDP is nearly 18 percent, and accounts for 15 percent of employment. Among ESC countries, Dominica, Suriname, and St. Vincent and the Grenadines' economies are the most reliant upon agriculture, totaling 13 percent, 10 percent, and 7 percent of their GDPs, respectively. However, for most other countries in the ESC region, agriculture makes up a small share of the economy [18]. Agriculture in the Caribbean, even without climate change, already faces significant challenges: most farms are small,

Climate Stressors and Climate Risk AGRICULTURE

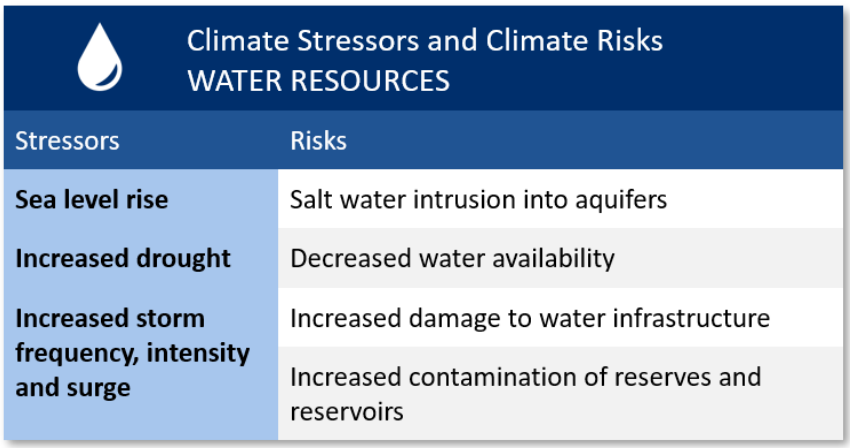
Stressors	Risks
Increased storm frequency and strength	Soil erosion and loss of soil fertility
	Storm damage to crops and livestock
Saline intrusion	Increased flooding and mudslides
	Unpredictable growing seasons
Increased drought	Water shortage
	Crop waterlogging, damage, and/or failure

labor costs are high, productivity is low, and farming has become less profitable [19]. Climate change will make an already brittle agriculture sector even more fragile. Droughts can result in less productive soil, while sea level rise can exacerbate the loss of coastal agricultural lands. Changes in temperature and humidity levels increase vulnerability to pests and the spread of invasive species [20]. Regional studies also show a link between livestock heat stress and insufficient animal protein production, particularly during the summer [21]. Changes in temperature and the unpredictability of rainfall can also affect the timing and yield of crops. This in turn, affects the value of feed for animals, diminishing the nutritional quality of meat, threatening food security, and prices [22, 23]. In addition, hurricanes can damage and destroy agriculture infrastructure, directly affecting food security.

Hurricane Dorian (category 5) devastated the Bahamas in 2019, causing $10 million in agriculture losses. Wind and salt-water intrusion decimated greenhouses and damaged perennial crops, which may take three to eight years to fully recover [24]. The storm also caused the loss of a poultry processing facility that provided food to local grocery stores. The 2020 Atlantic hurricane season was the most active ever recorded, with 30 named storms, 13 of which developed into hurricanes, more than double the average season of six named storms [25]. 2021 is forecasted to be another busy Atlantic hurricane season [26], with Hurricane Elsa having already made landfall in the Caribbean on July 2, 2021. National statistics on agricultural production belie the importance of the agricultural industry in directly contributing to livelihoods of low-income populations. Agriculture provides a social safety net for these communities by providing jobs, highlighting the challenge communities face as climate change worsens agricultural conditions in the region.

WATER RESOURCES

Water resources in the region vary considerably between countries. Some have extensive river systems with plentiful freshwater resources, and others have dry climates and more limited access to water. Because many of the islands are small, and some are primarily porous limestone, both surface water and groundwater sources can be limited, and vulnerable to pollution and saltwater intrusion. Poor sanitation infrastructure, for example, can cause contamination of surface- and groundwater [27]. During El Niño/Southern Oscillation events, the region typically experiences drought [28]. The entire ESC area has faced drought-like conditions since 2015. Barbados stands out as “water scarce,” according to the United Nations Commission on Water, and currently relies on desalination facilities to provide freshwater. The facilities produce 30,000 cubic meters (7.9 million gallons) of water per day, which supplies water for up to 20 percent of the population[29]. The Barbados drought of 1994-1995, which put the country on a scarcity level near many Middle Eastern desert nations, triggered the need for saltwater desalination [30]. Climate variability and change pose significant threats to an already stressed water sector. Floods and landslides can decrease the availability and accessibility of water through contamination and infrastructure damage [31]. In addition, sea level rise and storm surge could introduce saline water into freshwater resources in coastal areas [32]. Damage to water and



Climate Stressors and Climate Risks
WATER RESOURCES

Stressors	Risks
Sea level rise	Salt water intrusion into aquifers
Increased drought	Decreased water availability
Increased storm frequency, intensity and surge	Increased damage to water infrastructure
	Increased contamination of reserves and reservoirs

sanitation infrastructure during hurricanes will likely increase as storms become stronger and more frequent. Additionally, the threat of increased drought in some islands and regions of Guyana [33] and Suriname [34] will put more stress on water resources. In Guyana in June 2021, significant flooding contaminated drinking water, caused power outages, and damaged homes and infrastructure [35, 36].

COASTAL RESOURCES

Much of the population and infrastructure are located along the coast in these 11 countries, including the mainland countries of Suriname and Guyana. The sea level is expected to rise 0.3 meters above 2000 levels by the end of the century [37]. This, combined with a greater risk of flooding due to increased tropical storm strength [38], will put significant stress on infrastructure and population centers. In Barbuda, Category 5 Hurricane Irma destroyed or damaged nearly 95 percent of all structures on the island in 2017. Early estimates placed the cost of rebuilding Barbuda up to $300 million. Hurricane Maria destroyed between 17,000 and 20,000 buildings in Dominica and displaced around 54,000 people (about 80 percent of the population of the island) [39], resulting in 31 deaths and 34 missing persons [40] (as of September 2018), and causing $1.37 billion in damages and losses (226 percent of GDP). In the Bahamas, Hurricane Dorian in 2019 destroyed houses, essential infrastructure, and commercial, tourism, fishery, and agriculture industries, totaling $3.4 billion in damages, losses, and additional costs [41]. Irma, Maria, Dorian, and other hurricanes and tropical storms have also severely damaged or destroyed ecosystems and their associated services. Energy and transportation infrastructure, including ports and roads, are particularly at risk of damage from tropical storms and sea level rise. In Guyana, widespread flooding in June 2021 swamped roads, homes, and farmland, resulting in contaminated drinking water, damage to food, household items, boats, and engines [42, 43]. Hurricane Elsa in July 2021 damaged the south of Barbados, including power outages, fallen trees, flash flooding, and roofs blown off [44].

Climate Stressors and Climate Risks
COASTAL RESOURCES

Stressors	Risks
Sea level rise	Damage to civic infrastructure, homes, and businesses
Increased storm frequency, intensity, and surge	Decreased access to energy
	Damage to local ecosystems, including mangroves and coral reefs (e.g., bleaching)
Ocean acidification	Increased erosion
Ocean warming	Decreased security in population centers

HEALTH

Climate variability and change can adversely affect human health in the eastern and southern Caribbean (ESC) in multiple ways. Infrastructure critical to health service delivery, such as hospitals, roads, clean water, and electricity are threatened by increasingly strong storms, creating a hardship for human health at an already vulnerable time. Climate change also increases the frequency and intensity of heat waves, which can lead to heat cramps, exhaustion, heat stroke, and death for people and livestock [45]. In addition, it creates an environment in which disease vectors like rodents and mosquitoes can flourish [46]. Diseases carried by the *Aedes aegypti* mosquito, including chikungunya, dengue fever, and Zika [47], are common in this region and may become more prevalent with increased temperatures or more standing water after rain events [48]. Further, after hurricanes, Caribbean communities have experienced outbreaks of water-borne diseases (hemorrhagic conjunctivitis), as in 2003 in Trinidad and Tobago [49]. Hurricanes Irma and Maria (2017) exacerbated challenges to medication supplies, acute care services, food, and communication [50]. Two studies estimate that 30 percent of deaths following Hurricane Irma and Maria were due to complications from poorly controlled high rates of non-communicable disease such as diabetes, hypertension, cardiovascular disease, asthma, chronic obstructive pulmonary disease, and mental health disorders [51, 52]. The health sector in the Bahamas was severely affected by Hurricane Dorian in 2019. Health infrastructure, equipment, and medical, water, and electrical supplies were severely affected, limiting the healthcare system's capacity. In addition, the storm placed more than 2,000 people in need of health services due to physical injury or disease [53]. Survivors of Dorian and other similar storms are also at elevated risk of suffering from mental health issues, such as post-traumatic stress disorder, depression, or anxiety disorders [54].

Climate Stressors and Climate Risks
HUMAN HEALTH

Stressors	Risks
Water scarcity	Increase in water-and vector-borne diseases
Increased storm frequency and intensity	Death and injury
	Lack of access to services
Increased heat	Damage to health infrastructure

TOURISM

Tourism in the region is primarily driven by the natural beauty, pleasant climate, tourism-specific infrastructure and amenities, beaches, and coral reefs prevalent throughout the Caribbean. Climate variability and change threaten these features. Because of the centrality of the beach experience to Caribbean tourism, most hotels and resorts are located close to the ocean and are low-lying. Additionally, the transportation, energy, and water infrastructure that are critical to a thriving industry are vulnerable to sea level rise and increased storm threats. The increased frequency of droughts in many of the Caribbean countries leaves the tourism industry vulnerable to water shortages. In addition, large-scale coral bleaching caused by rising ocean temperatures and water pollution could leave the coral reefs less appealing to divers and snorkelers [55, 56], decreasing their likelihood of visiting the region. This comes at a time when the COVID-19 pandemic has already dealt a harsh blow to tourism. The number of international tourist arrivals fell 76 percent in January 2021 in the Caribbean region, far worse than the year-to-date drop of 66 percent from January to December in 2020 [57]. Hurricane Dorian in 2019 catastrophically affected tourism infrastructure located near the Bahamas' shoreline, totaling $350 million in damages [58]. As the 2020 hurricane season began, the islands were still struggling to recover, and many of the countries found themselves at the convergence of a pandemic and impending hurricane season. This dual burden stifled rebuilding efforts, and crushed growth in a region where tourism accounts for 50-90 percent of GDP. There is also a concern that the "fear factor" associated with contracting COVID-19 may have a long-lasting impact on the region's tourism [59].

Climate Stressors and Climate Risks
TOURISM

Stressors	Risks
Increased drought	Increased water scarcity
Increased storm frequency and intensity	Damage to infrastructure and tourism businesses
	Beach erosion
Ocean acidification	Decreased fish population and visitation from scuba divers and snorkelers
Ocean warming	Coral bleaching

FISHERIES

The fisheries sector comprises only a small part of the regional economy [60]. However, fish stocks within the region are essential for maintaining traditional livelihoods, as a source of protein for local communities, and as a tourism attraction for scuba divers, snorkelers, and sport fishermen. Due to increased ocean temperatures, much of the coral in the Caribbean has experienced bleaching [61]. Bleached corals have lower growth rates, less capacity to reproduce, increased susceptibility to disease, and higher mortality rates [62]. With continued climate change, further increases in ocean temperatures will threaten the survival of the reefs. Sea level rise also threatens mangrove ecosystems, which serve as an important breeding ground for marine life and acts as a natural barrier to storm surge and flooding [63]. The impacts on the coastal ecosystem will affect the food chain, including birds, porpoises, and larger migrating fish such as tuna, disturbing fisheries, and ecotourism. More frequent and intense storms will likely cause significant investment losses among fishing companies and communities and will slow economic recovery. Hurricane Dorian caused $13.6 million in damages to fisheries in the Bahamas, and the storm surge affected all fishing and processing facilities [64]. Additionally, illegal, unreported, and unregulated (IUU) fishing is a major human-caused stressor on fisheries. Coupled with climate change, IUU fishing increases the threat to fisheries and biodiversity [65, 66, 67].

Climate Stressors and Climate Risks FISHERIES

Stressors	Risks
Coral bleaching due to ocean warming	Deterioration in coral reef habitat
	Decreases in migrating fish populations
Ocean acidification	Impact on other animals that rely on fish
Increased frequency and strength of storms	Loss of community livelihoods and impacts to community food security
	Loss of equipment and investments

RESILIENCE ASSESSMENT

USAID's Resilience Assessment for the Eastern and Southern Caribbean identifies gaps and recommendations to ensure that investments focus on the most significant needs of ESC countries, align with regional strategies, and target support that increases the region's resilience capacities. The assessment focused on six countries: Antigua and Barbuda, Barbados, Grenada, Guyana, Saint Lucia, and Trinidad and Tobago. The countries vary tremendously in size, geography, economy, and culture, and there are also vast differences in the capacity of each nation's institutions and communities to prepare for and recover from hazards. As a result, the assessment found that USAID/ESC could invest in strengthening the region's resilience most effectively by taking systems- and sector-level approaches [68]. In particular, the assessment found that while individual countries varied in resilience capabilities, seven critical gaps provide opportunities for USAID/ESC to strengthen resilience [69]. Five relate to enhancing the integration of resilience across systems and sectors, and two relate to strengthening citizen and community resilience [70].

STRENGTHEN INTEGRATION OF RESILIENCE ACROSS SYSTEMS AND SECTORS [71]

Systems and Sectors	Gaps	Recommendations
Multi-Hazard Approach	**Gap 1:** There is a need for a coordinated multi-hazard approach to align information about response and recovery from hazards and to develop integrated strategies to build mutually reinforcing resilience.	**Recommendation 1:** Promote and support developing an integrated multi-hazard approach.
National Capacity	**Gap 2:** Disaster risk reduction and climate change adaptation is siloed across sectors and services, and there is weak collaboration and coordination among government offices, which undermines effective planning and response.	**Recommendation 2:** Build the national capacity for the sector and inter-ministerial integration.
Sustainable Independence	**Gap 3:** ESC island countries are highly dependent—economically and for resources—on other countries. The COVID-19 pandemic lockdown further highlighted the fragility of their mono-sector economies.	**Recommendation 3:** Build sustainable and equitable independence to increase resilience and self-reliance.
Financial Management	**Gap 4:** ESC countries face financial risk, significant budget volatility due to natural hazards, and struggle to move beyond disaster response towards mitigation and broader resilience.	**Recommendation 4:** Build financial management capacity for resilience.
Legal Frameworks	**Gap 5:** Existing disaster-based legal frameworks in ESC countries are primarily inadequate, limited in scope, and outdated.	**Recommendation 5:** Support national governments in strengthening legal frameworks for resilience.

STRENGTHENING CITIZEN AND COMMUNITY RESILIENCE [72]

Citizens and Community	Gaps	Recommendations
Local Capacity	**Gap 6:** Communities are strengths in ESC societies and their social dynamics and healthy, functioning ecosystems are critical for a community and region's ability to respond to chronic stresses and extreme events effectively.	**Recommendation 6:** Strengthen local capacity for resilience.
Youth Resilience	**Gap 7:** Youth are at risk of natural hazard impacts partially due to their limited voice and agency, lack of equitable access to resources, and high unemployment.	**Recommendation 7:** Empower youth resilience.

POLICY CONTEXT

Caribbean countries are aware of the threats of climate variability and change and many have undertaken actions to adapt. However, within the 11 nations served by the USAID/ESC Mission, the capacity to mitigate the risks posed by climate change vary.

Several regional plans and strategies have been developed to enhance cooperation and advance resilience to climate change. For example, the Caribbean Community (CARICOM) has been a frontrunner on the climate policy stage. Established in 1973, CARICOM is a key multilateral body of Caribbean states with the following goals: economic integration, foreign policy coordination, human and social development, and security. CARICOM has 20 member countries, including all 11 states supported by USAID in the Eastern and Southern Caribbean [73]. Under the 2019-2023 Initiative of the African, Caribbean, and Pacific Global Climate Change Alliance+ (Intra-ACP GCCA+) Programme in the Caribbean: Enhancing Climate Resilience in Caribbean Forum (CARIFORUM) countries, €12 million (almost $15 million) was raised to help countries. Intra-ACP GCCA+ helps countries improve monitoring networks for climate events, improve water infrastructure, and build the capacity of governments and the private sector to spearhead risk mitigation. Furthermore, the program has a keen interest in education and outreach on climate resilience [74].

CARICOM's efforts extend further. The 2009 Liliendaal Declaration on Climate Change and Development included an ambitious goal to reduce CO_2 by at least 45 percent by 2020 [75]. The most recent data, available until 2018 from the Energy Information Administration [76], reveals that the ESC region's CO_2 emissions have been rising since 1990. Nevertheless, the long-run goal of reducing greenhouse gas

emissions by more than 95 percent of 1990 CO_2 levels by 2050 [77], with appropriate action, is achievable. CARICOM is also working to improve disaster resilience in the region through social protections, safeguarding infrastructure, enhancing economic opportunity, protecting the environment, and mobilizing readiness and recovery. Countries are provided with recommendations to make these improvements. For example, to provide social protection for the marginal and vulnerable in society, they advise to "leverage National Security Social Protection programs and policy frameworks for all levels of human vulnerability recognizing the reality of shocks (natural and human-induced) ensuring no discrimination" [78].

The Organisation of Eastern Caribbean States (OECS) is also a critical mobilizing force in the region to deliver emissions reductions. The OECS Commission supports activities to accelerate green growth and improve resilience to the impacts of climate change via their Eastern Caribbean Regional Climate Change Implementation Plan [79].

The resilience of countries is a high priority under the USAID/ESC Mission's Regional Development Cooperation Strategy for 2020-2025. Under this strategy, the ESC Mission will build regional, national and community-level resilience to climate change specifically, as a key strategy for reducing overall risk from natural hazards [80].

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Data for map sourced from: World Wildlife Fund Terrestrial Ecoregions of the World (https://www.worldwildlife.org/pages/conservation-science-data-and-tools)

SELECTED ONGOING INITIATIVES

Below are selected projects which support climate change adaptation in the Caribbean region.

Selected Program	Amount	Donor	Year	Implementer
Procurement Procedural Framework	$ 205 million	European Investment Bank and Caribbean Development Bank	2011– ongoing	Caribbean Development Bank
Organization of Eastern Caribbean States (OECS) Regional Tourism Competitiveness	$ 26 million	The World Bank	2017–2023	International Development Association
OECS Regional Agriculture Competitiveness Project	$ 9.66 million	The World Bank	2017–2023	International Development Association
Collaborative Social Accountability for Improved Governance in Protecting Biodiversity Hotspots Project	$ 0.5 million	The World Bank	2021	Instituto tecnológico de Santo Domingo , Integrated Health Outreach
Caribbean Ocean and Aquaculture Sustainability Facility (COAST) Project	$ 2.4 million	The World Bank	2020-2022	Caribbean Catastrophe Risk Insurance Facility
Climate Resilience of the Water Sector in the Bahamas	$ 50 million	Green Climate Fund	2020-ongoing	Caribbean Development Bank
EU/CARIFORUM Strengthening Climate Resilient Health Systems Project	$ 8.28 million	European Union and CARICOM	2020-ongoing	Pan American Health Organization
Intra-ACP GCCA+ Programme In the Caribbean: Enhancing Climate Resilience in CARIFORUM Countries	$ 14.5 million	European Union	2019-2023	Caribbean Community Climate Change Centre

The following table shows the key national climate change commitments and policies from each country's intended nationally determined contribution (INDC) (38, 42). ***Note:*** *At the time of writing, countries are in the process of preparing their Nationally Determined Contributions ahead of the 26th United Nations Climate Change Conference (COP26).*

Country	Sectors for GHG Mitigation	Climate-related Policy or Strategy	National Adaptation Plan
Antigua and Barbuda	Energy	Climate change addressed in the Environment Protection and Management Act (2015)	Under development
Barbados	Energy and Waste	National Climate Change Policy (2012)	None
Dominica	Energy, Transport, Manufacturing and Construction, Commercial/institutional, Residential, Agriculture, Forestry, Fishing, Solid Waste	Low Carbon Climate Resilient Strategy (2012 - 2020)	National Adaptation Strategy for Agricultural Sector 2014-2020 (Spanish) National Plan of Adaptation for Climate Change 2015-2030 (Spanish)
Grenada	Electricity, Transportation, Waste, Forestry	National Climate Change Policy for Grenada, Carriacou and Petite Martinique (2017-2021)	National Climate Change Adaptation Plan (NAP) for Grenada, Carriacou and Petite Martinique
Guyana	Forestry, Energy	National Climate Change Policy and Action Plan (2020-2030)	National Adaptation Plan for the Co-operative Republic of Guyana, 2019
Saint Kitts and Nevis	All sectors	No information available	No information available
Saint Lucia	Energy, Electricity Generation, Transport	National Climate Change Policy and Adaptation Policy (2015)	National Adaptation Plan (2018-2028)
Saint Vincent and the Grenadines	All sectors	National Climate Change Policy of Saint Vincent and the Grenadines (2019)	National Adaptation Plan for St. Vincent and the Grenadines
Suriname	Forestry, Energy	National Climate Change Policy, Strategy and Action Plan (2014-2021)	Suriname National Adaptation Plan (NAP)
Trinidad and Tobago	Transportation, Power Generation, Industry	National Climate Change Policy (2011)	None

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