Jamaica's Adaptation Communication

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Final

Introduction

Adaptation is a critical element of Jamaica's action on climate change. This is especially relevant with the growing effects of climate change, evidenced in increased average temperatures, changes in rainfall patterns, rising sea levels and more extreme hydrometeorological events. These climate threats must be addressed comprehensively and sustainably for the country's development aspirations to become a reality, and for Jamaica to be "the place of choice to live, work, raise families and do business."

Jamaica's growth and prosperity rely on enhanced resilience and capacity to adapt to climate change as aptly captured in the Vision Statement of the draft Climate Change Policy Framework for Jamaica 2021:

> "Jamaica achieves its goals of sustained growth and prosperity for its people with enhanced resilience and capacity to adapt to the impacts and to mitigate the causes of climate change."

Jamaica's Adaptation Communication (AdCom) represents an opportunity to communicate progress in national adaptation action, and critically, highlight the gaps that remain in adaptation, finance, technical capacity, and technology. The AdCom was prepared to, inter alia, contribute to the technical assessment that will inform the First Global Stocktake (GST) of the Paris Agreement scheduled for completion in 2023. The GST will take stock of the implementation of [the] Paris Agreement", and particularly, progress in achieving its purpose and long-term goals.[1] With Jamaica being Party to the Paris Agreement since 2017, the AdCom will enhance recognition of Jamaica's progress in adaptation action and the gaps that constrain adaptation action and addressing limits to adaptation.

Jamaica's first AdCom will complement and support national progress on adaptation action. It will be used as a basis for guiding "coherent and enhanced support" for adaptation action that is to be provided to developing countries (Article 7, para 13 of the Paris Agreement) by highlighting some of Jamaica's current and projected adaptation priorities and, implementation and support needs. The AdCom will continue to elevate the importance of adaptation, catalysing wider incorporation of climate change considerations in national and sectoral development policies, strategies, and programmes. It will provide an important opportunity to highlight loss and damage, particularly as the implications of the limits to effective adaptation are recognised as growing threats to sustainable national development.[2]

As we stand on the decision threshold that will determine the quality of life for future generations, it is the hope of the Government of Jamaica that this Adaptation Communication will lend its weight to the contributions made by other countries, to provide an impetus for taking stronger action globally, to scale up adaptation finance, while making significant reductions in greenhouse gas emissions to limit the temperature increase to 1.5 °C target as per Article 2a of the Paris Agreement.

National Circumstances

Geography and Geology

Jamaica is located in the Caribbean region at latitude 18° North and longitude 77° West. Its topography is comprised of coastal and inland plains as well as a rugged interior which extends across the island from east to west. The majority of the island is composed of white limestone bedrock which facilitates the transportation and storage of rainwater, whether through surface flows or underground channels. Groundwater sources contribute an estimated 84% of the island's local freshwater supply.

[1] ***Long-term temperature goal*** (Art. 2) – The Paris Agreement, in seeking to strengthen the global response to climate change, reaffirms the goal of limiting global temperature increase to well below 2 degrees Celsius, while pursuing efforts to limit the increase to 1.5 degrees.
A***daptation*** (Art. 7) – The Paris Agreement establishes a global goal on adaptation – of enhancing adaptive capacity, strengthening resilience and reducing vulnerability to climate change in the context of the temperature goal of the Agreement. It aims to significantly strengthen national adaptation efforts, including through support and international cooperation.
Global Stocktake (Art. 14) – A "global stocktake", to take place in 2023 and every 5 years thereafter, will assess collective progress toward achieving the purpose of the Agreement in a comprehensive and facilitative manner.

[2] IPCC (2022). C3 Limits of Adaptation. In Summary for Policymakers Cambridge University Press. In Press. Pg. 28.

Replenishment of surface and underground freshwater resources is usually dependent on consistent rainfall patterns and seasonality. Hence, low periods of rainfall results in reduce surface flow and affect water availability. Other sections of the island consist of volcanic and Cretaceous deposits, as well as alluvium and yellow limestone. The island's rugged interior also dictates the organization of human settlements, critical infrastructure, and economic activities along the coastline (approximately 1,022 kilometres). These are generally exposed to storm surges, and coastal inundation. As a Small Island Developing State (SIDS), Jamaica is classified among the most vulnerable to hydro-meteorological hazards such as droughts, hurricanes, floods, landslides, tropical depressions etc. Generally, this heightened sensitivity to climatic hazards is due to the island's location within the hurricane belt of the North Atlantic region, its small size and rugged topography.

Climate Variability and Change

For Jamaica, dependence on the predictability and consistency of the climate is a significant element in the fabric of its existence and economic and social development. Variability and change in the climate system often disrupt and threaten the country's key socio-economic and environmental sectors and by extension, its ability to achieve development targets. According to Mora et al. (2013), tropical regions like Jamaica are expected to experience climate departures an estimated 15 years earlier than other parts of the world. It is projected that Jamaica will experience climate departure by 2023. Downscaled climate projections produced nationally (such as the State of the Jamaican Climate 2019) plus global climate models show that variability and change will continue in the short to long term, with various parts of the country experiencing varying degrees of change. As an example, eastern parishes which typically received the highest volumes of annual rainfall are expected to see a drying trend.

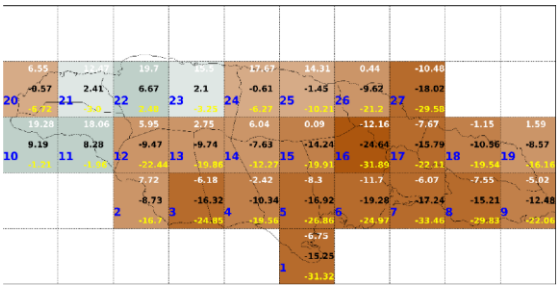

Figure 1: Rainfall projections to 2050 for Jamaica. Source: State of the Jamaican Climate 2019

Climate Threats

In recent decades, the island has experienced the impacts – directly and indirectly – of more intense storms and hurricanes, including Categories 4 and 5 strengths, while the occurrence of floods and droughts has increased since the 2000s. The island's rainfall pattern remains affected by tropical storms, hurricanes, frontal systems, and troughs, which often produce sustained rainfall. Furthermore, the occurrence of flood events has mirrored the island's bimodal rainfall pattern with the majority of floods occurring in the late rainy season. There has also been an increased frequency of seasonal drought events (short-term) compared to perennial drought periods. The coastal zone has been more prone to the effects of both seasonal and perennial droughts.

Downscaled climate projections for Jamaica, as documented in the State of the Jamaican Climate 2019[3], show that the observed trends will continue and worsen. Regardless of the development trajectory and consequent rate of increase in greenhouse gas (GHG) emissions, temperatures will increase. A drying trend is expected, especially from the mid-2030s, with spatial variations such that the south and east of the country will experience the highest decreases in precipitation. The east, particularly the parish of Portland, historically receives the highest volume of rainfall in the country. This shift towards dryer conditions will therefore have significant consequences for socio-economic activities. There will also be a continued rise in sea

[3] Second draft. Accessible via website: https://www.pioj.gov.jm/product/the-state-of-the-jamaican-climate-2019-historical-and-future-climate-changes-for-jamaica/

levels and the threats from stronger storms (categories 3 and higher) that will impact the entire coastline.

Environment

Often described as the 'land of wood and water', Jamaica hosts a rich natural environment. It has a dense riverine system, the majority of which originate from the hilly interior and flow in a northerly or southerly direction — except the Plantain Garden River which flows in an easterly direction. There are 10 Hydrological Basins which accommodate 26 watershed management units. These are managed as areas providing key sources of water for domestic use and environmental purposes. The island's physical topography and micro-climates accommodate a wide range of flora and fauna, several of which are endemic to the island (500 endemic species of snails, 31 endemic birds, over 900 endemic plant species etc.) (STATIN 2017).

Figure 2: The Blue and John Crow Mountains in Jamaica. Source: Ministry of Culture, Gender, Entertainment and Sport.

The coastal zone also supports diverse habitats including wetlands, mangroves, coral reefs and offshore cays. Both terrestrial and marine environments provide ecosystem services that are crucial for the island's economy and livelihoods, some of which include the protection of coastlines, source of food, income, and nurseries and feeding grounds for fishable resources.

Population

Jamaica's total population at the end of 2020 was estimated at 2,735,400 of which 50.6% (1,384,100) were females and 49.4% (1,351,300) were males (PIOJ 2021). Data revealed a rising dependent elderly age group (65+ years) which accounted for an estimated 13.9% of the total population, increasing from 12.4% in 2017. Characteristically dominated by women (52.4%), the elderly population has been projected to double by 2050, while the child population will continue to decline. The island continues to host a relatively large working-age population (15–64 years), accounting for 69.4% of the total population. Men tend to dominate a greater share of the total labour force. Their participation rate is also markedly higher where in 2019 it was recorded at 71% in comparison to 58.5% for women (PIOJ 2021). However, this was impacted by the COVID-19 pandemic, resulting in a labour force contraction of 2.4%. With regards to the spatial distribution of the population, 54% of Jamaicans reside in urban areas. This is projected to increase to 57.7% by 2025 (PIOJ 2019). The island's rural areas often feature higher poverty levels (PIOJ 2017, Carby 2012). This may be due to low incomes, limited opportunities linked to less rural (than urban) development, and low educational levels, among others. Between 2012 and 2015, the national poverty prevalence increased from 19.9% to 21.2%, affecting vulnerable groups such as women, children, youth, the elderly, and the disabled (PIOJ 2017).

Economy

Jamaica is classified as an upper middle-income country. Various fiscal measures have been pursued over the years to address consistently low GDP growth and high levels of public debt. In the last decade, government policy through cooperation with international financial agencies has successfully reduced debt and prompted an economic turnaround. However, the impact of the COVID-19 pandemic has eroded some of the gains; the real GDP for 2020 was estimated to have contracted by 9.9% (PIOJ 2021). Nevertheless, Jamaica's economy is expected to rebound to some degree (barring significant shocks), including through key economic sectors such as tourism and agriculture. Tourism is one of the country's largest sources of foreign exchange, where in 2019 it represented 31% of the island's total economic GDP (Collister 2020). According to the IDB's Tourism Dependency Index, Jamaica ranks as the 13th most tourism-dependent economy in the world. The agriculture sector remains a key sector in the employment of the

labour force, promotion of exports, food security, establishing self-sufficiency and sustaining rural livelihoods. Strategies such as strengthening and diversifying production systems, technological innovation and investment in value chain development are required. The nation's narrow production base and dependence on extractive and climate-sensitive sectors make it vulnerable to disruptions associated with external economic and climatic shocks.

Coherence and Synergies in the Governance Landscape

Vision 2030 Jamaica – National Development Plan

The Vision 2030 Jamaica-National Development Plan defines the country's long-term strategic development goals toward an inclusive, sustainable, and prosperous future for its people. The guiding principles of this development plan are anchored by its National Vision Statement: "*Jamaica, the place of choice to live, work, raise families and do business*." It rests on four strategic social, economic, and environmental goals that are the basis on which development targets will be realised. The 4th National Goal "*Jamaica has a healthy natural environment*" is actualised through three interrelated National Outcomes; the sustainable management of the environment and natural resources, hazard risk reduction (HRR) and adaptation to climate change (CCA), and sustainable urban and rural development.

Medium Term Socio-Economic Policy Frameworks (MTF) documents, evaluate, and report on, the implementation of prioritized policies, strategies, projects, and programmes, over successive three-year planning periods, until 2030. Each MTF is informed by a robust results-based monitoring and evaluation mechanism that tracks the performance of established development targets.

Vision 2030 Jamaica—National Development Plan, the Medium-Term Socio-Economic Policy Framework (MTF) and sectoral policies are strongly aligned with the United Nations' Sustainable Development Goals (SDGs). Jamaica's planning documents articulate either a full or partial alignment, with 91% of the 115 SDG targets considered applicable to the country.

Institutional arrangements were established to support the provision of strategic guidance on, and implementation of, Vision 2030 Jamaica. Among them was the establishment of the Hazard Risk Reduction and Adaptation to Climate Change (HRRCC) Technical Working Group (TWG). The Group's members represent the government, civil society, private sector, academia, and the International Development community. At present, the TWG is co-chaired by the Climate Change Division and the Office of Disaster Preparedness and Emergency Management (ODPEM).

The Climate Change Policy Framework for Jamaica, 2015

The National Climate Change Policy was developed through an inclusive, consultative process. It was developed in alignment with Vision 2030 Jamaica and informed by various policy-relevant reports and research, including Jamaica's Second National Communication on Climate Change to the United Nations Framework Convention on Climate Change (UNFCCC)[4]. The Climate Change Policy Framework seeks to, *inter alia,* create a sustainable enabling environment to facilitate the development, coordination, and implementation of measures to address the impacts of climate change; strengthen Jamaica's adaptive capacity and resilience to reduce its vulnerability to climate change; pursue low carbon development and enhance access to and mobilization of climate finance; and promote public education and awareness-raising, research and technology transfer. The policy also assigns coordination and facilitation responsibility for the achievement of national climate change policy goals to the Climate Change Division. The Policy defines the performance criteria and standards by which the implementing entity will be assessed. Institutional

[4] The Climate Change Policy Framework was prepared under a GOJ/EU/UNEP Climate Change Adaptation and Disaster Risk Reduction (CCADRR) Project.

arrangements established and supported under the Policy include the Climate Change Division, the Climate Change Advisory Board, and the Climate Change Focal Point Network. The policy is being updated to reflect current realities as well as updated information from the Third National Communication to the UNFCCC; as with the current policy, it has already benefited from broad stakeholder engagement.

Institutional Framework Enabling Climate Change Adaptation Planning

The Climate Change Division (CCD) in Jamaica was established in 2013. It has strategic responsibility for putting in place a mechanism to facilitate and foster the_integration of climate change responses in the development of policies, plans and actions across sectors and all levels of society. The CCD is guided by the Climate Change Policy Framework which includes forging strategic partnerships and facilitating resource mobilization that is essential for success.

The **Climate Change Advisory Board** (CCAB) consists of representatives from academic institutions, civil society organizations, youth and relevant government ministries, departments, and agencies, duly approved by the Cabinet. Their main role is to provide advice to the Government of Jamaica on issues relating to climate change through the Minister with responsibility for climate change and annual reports to the Cabinet of Jamaica (Mahlung 2021, 26). The CCD is the Secretariat for the CCAB.

The integration and mainstreaming of climate change across sectors are some of the main functions of the **Climate Change Focal Point Network members.** It is currently comprised of duly nominated representatives from government ministries, departments, and agencies. The focal points are charged with the responsibility of ensuring that climate change considerations are considered in the development and implementation of their respective sectoral strategies and actions, policies, plans, and programmes. The CCD is the Secretariat for the Network and facilitates its functioning through, inter alia, meetings, training and capacity building sessions, and study tours.

Various institutions and actors contribute to climate action and therefore are key players in the institutional arrangements. Among them is the **Planning Institute of Jamaica (PIOJ),** strategically responsible for national, policy coordination, development planning and implementation[5]. The PIOJ was established specifically to strengthen the planning capability of the Government and to initiate and coordinate the development of policies, plans and programmes for the sustainable development of Jamaica. The PIOJ has and continues to play a critical, strategic, coordinating and enabling role in climate change adaptation planning and capacity development through the execution of large climate change programmes and projects, maintaining a registry of all climate change projects and programmes implemented in Jamaica, and coordinating their monitoring and evaluation. Important also is the PIOJ's role as the host of the Vision 2030 Jamaica Secretariat and as one of the national focal points for the Sustainable Develop Goals.

National Adaptation Plan (NAP)[6]

Jamaica is in the preliminary stages of developing its first NAP, having received approval from the Green Climate Fund (GCF) readiness and preparatory support programme, in April 2021. The overall goal of the NAP project is to develop an inclusive, systematic, and participatory national adaptation planning and implementation framework for Jamaica by 2025.

The NAP preparation process will be used to advance Jamaica's national adaptation planning framework, building on existing governance and coordination mechanisms, strengthening the capacities of sectors, and enhancing institutions already putting appropriate systems in place to monitor and evaluate adaptation benefits. As a complement to the NAP, a financing strategy and investment plan, as well as a private sector engagement strategy, will be

[5] Planning Institute of Jamaica Act. URL: https://moj.gov.jm/sites/default/files/laws/Planning%20Institute%20of%20Jamaica.pdf.

[6] https://www.greenclimate.fund/sites/default/files/document/towards-comprehensive-national-adaptation-planning-process-jamaica-ja-nap.pdf

developed. Work will also be pursued to have vertical integration of the NAP with local level planning mechanisms, including local governments (Municipal Corporations, MCs). As a participating country of the Local Climate Adaptive Living Facility (LoCAL) managed by the United Nations Capital Development Fund (UNCDF), Jamaica will seek to enhance the capacity of MCs to integrate climate change in development planning and implementation, and also to access climate finance.

National Reports to the UN Framework Convention on Climate Change (UNFCCC)

Within the wider UNFCCC and Paris Agreement transparency and reporting system, Jamaica has successfully submitted the following:

- First[7], Second[8] and Third[9] National Communications
- First Biennial Update Report (BUR)[10]
- Intended and updated NDCs

National Communications have been valuable resources for Jamaica, providing data and information on the impact of climate change on various aspects of society and selected vulnerable sectors. Work is underway to prepare the fourth national communication and second BUR. With sufficient support, Jamaica will continue to improve on its transparency reporting including the biennial transparency reports (BTRs) which are required, starting in 2024.

Nationally Determined Contribution

Jamaica's updated Nationally Determined Contribution (NDC) was submitted to the UNFCCC in June 2020.[11] The update provided for a more economy-wide approach to reducing greenhouse gas emissions and the enhancement of sinks. This includes a focus on the energy and land-use sectors (including forestry). Important also is the inclusion of mitigation and adaptation co-benefits of these measures. Jamaica's NDC Implementation Plan was launched in October 2021. It sets the framework for support to be provided and consequently, the mitigation and adaptation co-benefits[12] to be realised.

Long term strategy – adaptation resilience

A long-term strategy for Low Carbon Emissions and Climate Resilient Development (LTS) will be developed with consideration of both mitigation and adaptation options. Through its LTS, the Government of Jamaica (GOJ) will develop a more robust climate change strategy that considers options for both mitigation and adaptation together in an integrated long-term planning framework to 2050. Based on the projections of increased future climate hazards, the LTS Report will offer short and long-term adaptation and mitigation recommendations for each sector (energy, industry, transport, environment, infrastructure, agriculture, forestry, tourism, health, and housing). It will also include possible institutional framework and technical support that will be necessary to implement the strategy. The final strategy will be presented to Cabinet for approval and will influence, inter alia, other policy and planning documents including the NAP.

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7 https://unfccc.int/sites/default/files/resource/Jamaica%20INC_0.pdf
https://unfccc.int/sites/default/files/resource/Jamaica%20INC_0.pdf

8 https://unfccc.int/sites/default/files/resource/snc2_Jamaica.pdf
https://unfccc.int/sites/default/files/resource/snc2_Jamaica.pdf

9 https://www4.unfccc.int/sites/SubmissionsStaging/NationalReports/Documents/578491_Jamaica-NC3-1-TNC_Final_December132018.pdf
https://www4.unfccc.int/sites/SubmissionsStaging/NationalReports/Documents/578491_Jamaica-NC3-1-TNC_Final_December132018.pdf

10 https://unfccc.int/documents/180654
https://unfccc.int/documents/180654

11 https://www4.unfccc.int/sites/ndcstaging/PublishedDocuments/Jamaica First/Updated NDC Jamaica - ICTU Guidance.pdf

12 The positive effects that a mitigation and adaptation policy or measure aimed at reducing GHGs, climate risk and enhancing resilience, might have on other national and local policy or development objectives, e.g., reduced air pollution, water production and availability, coastal water quality, livelihoods sustainability, human health, ecosystem health and productivity.

Disaster Risk Reduction

At the international level, climate change adaptation is considered in national disaster risk reduction strategies, as guided by the Sendai Framework for Disaster Risk Reduction (2015 – 2030). At the national level, Jamaica's Office of Disaster Preparedness and Emergency Management (ODPEM) has collaborated with Caribbean Disaster Emergency Management Agency (CDEMA) to incorporate climate change considerations into Jamaica's national comprehensive disaster management (CDM) country work programme.[13] [14] The Government of Jamaica is taking steps to ensure that the synergy between national disaster risk management and climate change adaptation mandates continues, and is updated and strengthened, to reflect the priorities of the Sendai Framework for resilient and sustainable institutional arrangements.

Regional Climate Change Plans

At the regional (Caribbean) level, a series of strategically designed initiatives has provided support for the development of long-term, strategic, capabilities for the implementation of the Caribbean's vision of resilient development in the face of climate variability and change. The Caribbean Community Climate Change Centre (CCCCC) was established as an articulated network of centres of excellence, facilitating the enhancement of the capabilities of organisations to contribute to national and regional efforts in climate change adaptation planning. The centres or organisations include, *inter alia*, the University of the West Indies Climate Studies Group Mona (Jamaica Campus) and Computer Centre (Barbados Campus), the Caribbean Institute of Meteorology and Hydrology, the Caribbean Agricultural Research & Development Institute, INSMET (Cuba), and the Caribbean Public Health Agency. Jamaica currently chairs the Board of the CCCCC.

Cross-cutting Considerations

Though the Adaptation Communication is focused on climate change adaptation, the relationship between climate change and disaster risk management (DRM) should not be overlooked or minimised. Their connection has been particularly evident in the designing of national and regional intervention policies, investment portfolios and methodological frameworks used to shape decision making processes and mainstream resilience packages. The relationship between the two areas presents an opportunity for maximizing resources and improving efficiency in action.

The 2011 National Policy for Gender Equality acknowledges the need to minimize the differential effects of climate change and natural disasters on gender by actively involving women in various levels of environmental decision-making, as well as integrating gender concerns and perspectives in policies and programmes. In July 2022, a working draft of Jamaica's Gender and Climate Change Strategy and Action Plan was launched, a step to further integrate gender in climate action, while also recognising the impact of climate change on gender. The GOJ is also committed to implementing the Sendai Framework for Disaster Risk Reduction (2015 - 2030) and the Comprehensive Disaster Management (CDM) Strategy and Action Plan (2014 -2024) which seek to mainstream gender into disaster risk management policies and programmes.

The Green Climate Fund, through its readiness programme, approved resources to support the "Facilitating a gender-responsive approach to climate change adaptation and mitigation in Jamaica" project[15]. In summary, the project is

[13] ODPEM, CDEMA Discuss Ways to Integrate Climate Risk into Disaster Risk Management: https://www.jamaicaobserver.com/news/ODPEM--CDEMA-discuss-ways-to-integrate-climate-risk-into-disaster-risk-management_17355341

[14] Mainstreaming Climate Change Adaptation into the CDM Country Work Programme: (URL (16SEP21): http://unfccc.int/files/adaptation/application/pdf/cca_guidance_tool_e_book_.pdf.

[15] https://www.greenclimate.fund/sites/default/files/document/facilitating-gender-responsive-approach-climate-change-adaptation-and-mitigation-jamaica.pdf

building on work already being pursued, to better integrate gender through assessments, strengthening dialogues among gender and climate change focal points, and preparation of a Gender and Climate Change Strategy and Action Plan. Jamaica's NAP will also be gender-responsive, and include the development or identification of relevant gender-sensitive adaptation indicators.

Jamaica launched its Climate Change Research and Technology Development Agenda in July 2021. It is the first formalized agenda that outlines the roadmap for research and technology to support the NDC and selected adaptation priorities. Its implementation will address problems related to climate variability and change, and consolidate, streamline, and expand on previously implemented climate actions. Other key research areas include *inter alia*: (a) the ongoing development and refinement of the capabilities of the Climate Studies Group Mona (CSGM) in downscaling climate change projections to guide Jamaica's climate policy, planning, and adaptation decisions; (b) establishing a high-performance computing and storage system for climate modelling to facilitate the processing of 'big data' for Jamaica and the small island developing states (SIDS) in the Caribbean, and (c) the expansion of the national real-time data collection system of rain gauges, stream gauges, and sea level tide gauges, and automatic weather stations for enhanced data collection/research and the operation of effective hydro-meteorological early warning systems.

Impact, Risk and Vulnerabilities

As a climate-sensitive country, Jamaica's social and economic sectors are highly susceptible to extreme hydro-meteorological events such as storms, hurricanes, flooding, coastal inundation, saltwater intrusion, and droughts. This often leads to the damage of infrastructure, the disruption of livelihoods, decreased economic output, loss of production systems and the disruption of social services such as access to water for sanitation and hygiene. Due to their vulnerability and risk to climatic impacts, the sectors listed below were selected as areas of priority for the Adaptation Communication. Jamaica's National Communications have acknowledged these sectors as critical to Jamaica's growth and development strategy, highlighting the need to address the severe disruption and major threats to these sectors posed by climate change. Therefore, adaptation planning at the local, national, and sectoral levels is an attempt to reduce the vulnerability of sectors, communities, and social and economic assets to climate impacts, while facilitating the social and economic development essential to national growth and survival.

Tourism

As a climate-sensitive sector, changing climatic conditions are expected to have significant adverse impacts on the tourism industry. Considering that the island's coastline is densely populated with hotels and tourist facilities, it is estimated that "a 1m rise in sea level will impact about 8% of major resorts in Jamaica, while a 2m rise will have an impact on 18% of these resorts" (ODPEM 2015). These buildings and infrastructure are also highly exposed to the impacts of hydro-meteorological events such as tropical storms, and hurricanes. Projected to increase in frequency and intensity, these events threaten tourist facilities and the wider sector through various physical, social, environmental and economic impacts.

Agriculture and Fisheries

The island's agriculture sector is extremely sensitive and vulnerable to climate change. It is a key socio-economic sector, contributing 7.8% of GDP (PIOJ 2021) and accounting for some 16% of the labour force (STATIN 2021). Increasingly, the growth experienced in the sector is eroded by the impacts of extreme hydro-meteorological events, including storms and drought that result in crop losses and a decline in production. In 2019, for example, a few thousand farmers lost crops directly due to drought as well as fires exacerbated by drought conditions[16]. The damage and loss in the agriculture sector continue to be significant, jeopardizing livelihoods, economic returns and production growth.

[16] Economic and Social Survey Jamaica, 2019

Changing climate is expected to further exacerbate declines in the fisheries sector, impacting livelihoods, as well as the location, abundance, and availability of fishable resources. The projected increase in the frequency and intensity of storms and hurricanes will adversely affect the fisheries sub-sector, including infrastructure and equipment, fish stocks, and fishing habitats. Coastal fishing communities will become increasingly vulnerable to storm surges, beach erosion, coastline retreat and coastal inundation.

Health

"The Jamaican health system and economy are susceptible to the direct and indirect effects of climate change" (WHO 2017). Over the last decade, the island has been impacted by intense tropical storms and hurricanes causing loss of life through flooding and landslides. Critical health facilities are situated along the coastline, thus increasing their vulnerability and exposure to infrastructural damage from strong winds, heavy rains and flooding. Efforts are underway to bolster the health system and infrastructure through training, retrofits and awareness-raising programmes, among others. However, significant gaps remain in these areas and others such as the collection and use of applicable data and information for the sector. The COVID-19 pandamic also revealed the vulnerabilities of the sector which has implication for its responsiveness to climate change, including the impact of extreme events.

Water, Sanitation and Hygiene

Jamaica's local water resources are expected to be significantly impacted by changing climatic conditions. The island has already been experiencing increased variable rainfall, prolonged drought conditions, increased evapotranspiration, and saline contamination of groundwater resources, all leading to a decline in the supply and distribution of water across rural and urban landscapes (CSGM 2017; GOJ 2015a). Additionally, the sector is challenged by its old infrastructure which has contributed to leakage and frequent water supply disruptions. Hence, communities are even more affected by water lock-offs or the intermittent provision of water service due to increasingly frequent dry spells and drought conditions (GOJ 2019a, 9). In periods of heavy rainfall events, the sector has also been affected by high levels of siltation and damage to pipelines.

Natural Resource (terrestrial, coastal, and marine, biodiversity)

Jamaica's economy and the social well-being of its citizens are dependent on, and are mediated by, the state and the condition of its limited endowment of natural resources. They have been proven to provide valuable ecosystem services but show susceptibility to changes in climatic conditions such as higher air and sea surface temperatures, more intense storms and hurricanes, droughts, floods, ocean acidification, and sea-level rise. This will result in further losses of biodiversity and ecosystem services. Rising temperatures are projected to affect: the reproduction of sea turtles since sex is determined by temperature; coral reefs, especially bleaching events that reduce their ability to withstand the impacts of extreme events; and also leads to habitat loss for reef fish and their eventual decline. The impact of these resources are also expected to increase pests and diseases.

Human Settlements and Infrastructure

Most of Jamaica's major towns, cities, housing and key infrastructures are concentrated on the coastline. Between 2011 and 2015, residences in coastal communities and/or within 5km of the coastline increased from 60% to 82% (GOJ 2015a; World Bank 2011). The Human Settlement and Infrastructure sector usually suffers from extensive loss and damage during extreme hydro-meteorological events. In 2004, an estimated 14% of the country's housing stock was significantly damaged by Hurricane Ivan, with economic loss and damage being valued at JMD$11,163 million (PIOJ 2004). Informal settlements characteristically occupy high risk and/or disaster-prone areas in rural, urban, and coastal areas. Approximately 55% of informal settlements are located on flood plains and along the coast; 17% are located on moderate slopes, while 6% occupy very steep slopes (GOJ 2019b). Extreme hydro-meteorological events heighten the probability of individuals being displaced, communities being isolated by landslides, floods, and the destruction of transportation, water and solid waste infrastructures.

Energy

The impacts of changing climatic conditions can adversely affect energy supply and distribution (CSGM, 2017). The transmission and distribution of electricity across the island are dependent on the continued operation of the island's main electricity provider. However, most of the infrastructure including load centres, generating plants, service stations wind farms and power lines are mainly located along the coast, leaving them highly exposed to the impacts of extreme hydro-meteorological events. Likewise, an increase in temperatures will likely increase energy demand for cooling, and increase inefficiencies, while sea-level rise is likely to affect coastal power stations (CSGM 2017). Furthermore, the ageing infrastructure of fossil fuel plants (some over 30 years old) is also threatened by the passage of intense storms and hurricanes (TNA 2020).

Transportation

Jamaica's transportation sector is already being affected by extreme weather events. Frequent damage to roads, bridges, drains and other infrastructure has become the norm during the passage of tropical cyclones and the occurrence of intense seasonal rainfall. According to PIOJ (2017), "since 2001, damage and loss related to infrastructure have cumulatively accounted for $54.8 billion or 42.65 of the overall costs related to extreme weather events. Of this amount, damage to transportation infrastructure accounted for 87%."

Vulnerable Groups

- Women, Youth and the Elderly

Women, men, rural households, the elderly, female-headed households, and the younger population all have different levels of vulnerability to disasters. The elderly face increased climate risks including exposure to extreme heat stress, poor air quality, vector-borne diseases, droughts and flooding. Individuals with underlying illnesses such as respiratory problems, heart conditions as well as other chronic health conditions and disabilities are particularly vulnerable to these impacts. This has been supported by research, including local academic institutions. Climate change will also affect genders differently and exacerbate the gender roles and structural inequality between men and women that prevail within the society (GOJ 2018, 45). Gender-responsive, participatory, inclusive, and transparent approaches are therefore being mainstreamed into climate change adaptation and resilience-building measures. This is particularly considering that women can play a role as agents of change in building resilience to the impacts of climate change.

- Children

Children will bear an undue burden on account of climate change. Climate-related impacts will disrupt educational, recreational, and health-related services and activities. Children in poverty and hazard-prone areas are even more vulnerable. Twenty-two (22) of Jamaica's national policies, strategies and plans assessed found that under 20% of the policies explicitly highlighted the linkages between climate, environment, energy, and children (UNICEF 2020). The current widespread acknowledgement of the vulnerability of children to changing climatic conditions has become integral to conventional development plans. One of the interventions that have been initiated across the country is the mainstreaming of climate change issues in primary and secondary level curricula.

- Persons with Disabilities

Persons with disabilities (PWDs) are among the vulnerable groups whose needs must considered in development priorities, plans and strategies. According to the 2011 census, approximately 22.5% (607,393) of the Jamaican population have some form of disability. PWDs often experience climate-related impacts more severely. Mobility, communications, and access to information are challenges that PWDs may experience when attempting to prepare for extreme hydrometeorological events, and in the immediate aftermath of a disaster. Difficulty accessing emergency shelters, or health care services for routine care during and after extreme climatic events may place PWDs at heightened risk. The vulnerability of the disabled, homeless, women and girls, is increased by exposure to abuse in emergency shelters (UNICEF 2020). The Jamaica Disaster Response system is being progressively reviewed and updated to address the needs of PWDs. Independent projects and programmes have made

attempts to fill these gaps and additional, continued support would further advance this effort.

Loss and Damage

There is growing recognition that mitigation and adaptation measures will be insufficient to prevent or alleviate all climate change impacts (Kreienkamp & Vanhala 2017; IPCC 2022).[17] Despite mitigation and adaptation action, loss and damage is expected to occur and increase due to the cumulative nature of adverse climate change impacts (GIZ, 2017), and the existence of both soft[18] and hard[19] limits to adaptation[20] (GOJ, 2021; IPCC, 2022). Various planning instruments have implicitly and explicitly included action on loss and damage, but this is a growing area of concern to be further expanded and explored. Jamaica's Mid-term Socio-Economic Policy framework 2018-2021 (MTF 2018-2021), as an example, recognises that whilst "*…prevention and mitigation efforts are indispensable steps to build resilience, no country can fully insulate itself against losses from adverse natural events*." (PIOJ 2018, 312). The implication of certain, "residual effects" of climate change that cannot be avoided through mitigation or adaptation, necessitates additional considerations and mechanisms to address this issue.

Jamaica's Climate Change Policy Framework (2015) is explicit in referencing loss and damage as an important element of climate change action and provides the policy directive for current and future consideration of this issue in national development and sectoral planning processes. In the revision of the Climate Change Policy Framework, the issue of loss and damage has remained a priority, (CCD 2019, 6; GOJ 2021, 9).

Since 2000, Jamaica has been affected by natural hazards on average every two years. Estimates of the economic impact from extreme events since then average about 1.3% of GDP per year, costing cumulatively well over J$136 billion[21]. The impact has been extensive on infrastructure, productive sectors and social sectors; there has also been a toll on the natural environment though costing the impact has been challenging. Numerous persons have died or been injured, and hundreds of communities have been affected. The impact of slow onset events such as sea level rise has been growing; Jamaica currently does not have the ability to cost this type of impact, but evidence show a growing impact, with loss of territory, cultural and heritage sites as well as consequent displacement (human mobility). Permanent displacement has occurred in several locations, where the coastline has eroded to render previously habitable areas, unliveable.

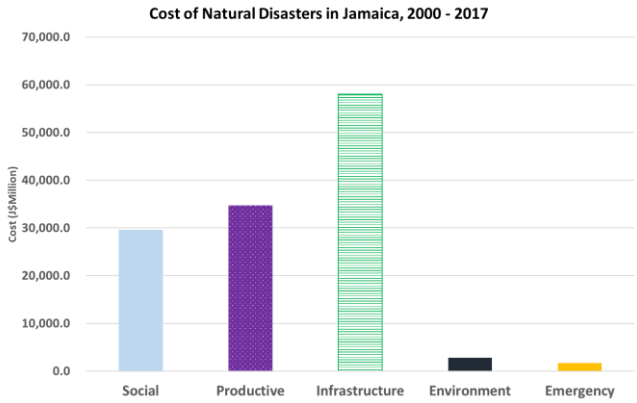

Figure 3: Estimate economic costs of extreme hydro-meteorological events from 2000 to 2017. Source: Planning Institute of Jamaica (various damage and loss assessment reports)

[17] Article 8 of the Paris Agreement reaffirms the Warsaw International Mechanism for Loss and Damage as the main vehicle under the UNFCCC process to avert, minimize and address loss and damage associated with climate change impacts, including extreme weather events and slow onset events (GOJ 2021. Pg. 17).

[18] Some coastal settlements face soft adaptation limits due to technical and financial constraints on implementing coastal protection and/or planned relocation. Inequity and poverty also constrain adaptation, leading to soft limits, and resulting in disproportionate exposure and impacts for most vulnerable groups (IPCC, 2022. Pg. 28).

[19] Ecosystems already reaching or surpassing hard adaptation limits include some warm water coral reefs and some coastal wetlands. Limited freshwater resources pose potential hard limits for Small Islands (IPCC, 2022. Pg. 28).

[20] Above 1.5°C global warming level, some Ecosystem-based Adaptation measures will lose their effectiveness in providing benefits to people as these ecosystems will reach hard adaptation limits. At this point the country would be exposed to the double jeopardy of losing adaptation options that are accessible, affordable and cost-effective options, while losing the ecosystem services (e.g., regulating, provisioning, supporting, cultural) on which sustainable national socio-economic development is based.

[21] Calculated from various damage and loss assessments produced by the Planning Institute of Jamaica

Box 1: Jamaica's Adaptation Progress

Since becoming a Party to the UNFCCC in 1995 and subsequent participation in regional initiatives, Jamaica has strengthened its drive towards reducing climate risks and expanding its capacity to adapt. An adaptation stocktake conducted in 2020 highlighted over 150 adaptation initiatives implemented across the island, supporting and aligning with national development policies and plans. Adaptation progress has been made possible through collaboration with the academic community, state MDAs, the private sector and civil society. Hence, progress in climate change adaptation may be reflected in:

- The institutional framework designed to coordinate, implement, and mainstream climate change adaptation into development strategies and plans
- The strengthened partnerships, collaboration and information sharing among stakeholders
- The improved technological innovations across sectors (eg. installation of marine, meteorological, and hydrological data collection systems; shoreline protection with hard and soft technologies; installation of water-harvesting systems; installation of early-warning systems; tools for climate resilient decision-making; coral reef monitoring etc.)
- The acceleration of climate-smart techniques (eg. sustainable farming practices)
- The capacity-building of diverse stakeholders (eg. trainings; climate modelling; vulnerability, adaptation, and risk assessments etc.)
- The advanced communication and awareness of climate issues and environmental sustainability (eg. use of natural ecosystems for coastal protection; improved watershed management; land protection etc.)

Priority Implementation and Support Needs

There have been ongoing adaptation efforts across various sectors over the past few decades. Some are outlined in this section. Also highlighted is a summary of the implementation and support needs which remain.

Tourism

There has been steady work on building resilience in the sector through various initiatives. These include vulnerability assessments of selected vulnerable areas; drafting of plans and strategies for national and resort level action; workshops and training of key sector interests, including the private sector; and concrete activities to protect coastal resources (beaches and coral reefs, etc.). Nonetheless, these types of adaptation action are and must remain iterative, and must also be sustained and programmatic. Other needs include continued screening for climate risks; implementation of climate-proofing measures; support to further identify and address risks to the tourism product including infrastructure and natural assets and value chains. There is an opportunity to strategically consolidate the data, information, and lessons that have been generated to date on adaptation action.

By 2025, the tourism sector will develop a tourism sector climate change adaptation strategy and implementation roadmap. The aim is to conserve or maintain the quality of the national tourism product and ensure its medium- to long-term viability.

Agriculture and Fisheries

The sector has made significant progress but is still at high risk due to the increasing effects of climate change and the inability of technology and relevant capacities to keep pace. Much has been done in, for example, introducing climate-smart agriculture to farmers and retooling extension services. There is also ongoing research on climate-resilient crops and options for risk transfer. Much has also been done to increase awareness and use of climate data and forecasts to reduce losses. Nonetheless, these measures need to be scaled up and expanded, particularly in areas yet to benefit. Risk transfer options such as insurance are yet

to be mainstreamed but are important for vulnerable farmers and fisherfolk. Some specific areas include:

- Financing and technical capacity to increase research on heat-tolerant crop varieties as well as their economic viability in local conditions
- Expanding the use of alternative/renewable sources of energy in drip-irrigation, storage facilities, cooling systems in the livestock sub-sector and transportation
- Financing and technological support to increase the use of crop modelling and pest management forecasting software
- Financing and technical capacity to increase adoption and application by farmers of agroecological principles of pest management, soil conservation, water conservation and environmental protection.
- Financing for the materials and logistics to implement Climate Smart Agriculture (subsidies required to better access appropriate tools and equipment, and technical capacity)
- Improve and expand the use of information and communication technology (ICT), including relaying climate/weather-related data and messages to and among farmers and fishers
- Technical capacity to incorporate Blockchain technology in production systems to improve linkage among producers, buyers, and suppliers.

Health

The health sector has made strides in assessing its vulnerability and implementing measures accordingly. In recent times, assessments were conducted of healthcare facilities and supporting systems including emergency power supply and drainage systems; costing was also done. Therefore, a critical need is financing to address the vulnerabilities identified. Improving the capacity of healthcare professionals has also been a priority, facilitated by training and other activities. Concerning the planning landscape, a National Adaptation Plan (NAP) specific for the health sector is to be developed; standards for infrastructure are also being updated to include climate considerations. Support will be needed to implement the relevant and appropriate activities as outlined in this instrument. Additionally, specific areas for support include:

- Funding for the expansion of real-time data gathering technology, e.g. early warning systems for vector-borne diseases (mosquito), heat stress and other morbidities, as well as capacity to ensure system maintenance and data management
- Funding to expand community outreach and intervention programmes with specific inclusion of climate change considerations; e.g., the Extension of Community Healthcare Outcome (ECHO) programme
- Addressing the risk and displacement of women and girls and other vulnerable groups during and post disasters.
- Financing to retrofit health facilities to meet climate change standards, including protection against wind, and floods, as well as increase water storage capacity during dry spells
- Support research capacity on heat stress (including youths and outdoor workers), to document evidence and support local interventions, and other health-related issues.

Water, Sanitation and Hygiene

Water is critical to every other sector. Therefore, the vulnerability of the sector to climate risks has far-reaching implications. Several adaptation initiatives are underway, spanning reduction in non-revenue water, awareness-raising programmes promoting household-level storage and conservation, and programmes targeting housing and other building construction developers to install water-saving devices, among others. Several rainwater harvesting systems have been

installed across communities, schools, and agriculture networks, *inter alia*. The policy landscape has also improved with the promulgation of the Water Sector Policy in 2019. Undergirding these activities are improvements in the collection, storage and analysis of hydro-meteorological data including real-time data collection stations across the island. Nonetheless, there is a "moving target" for making the sector resilient to the effects of climate change. This demands, continuing the work already underway while also pursuing new and innovative options for adaptation. Selected additional activities include:

- Funding to improve the design and expand locations for implementing water capture and storage facilities, including micro dams
- Funding to support the use of nature-based solutions to adapt to climate change as they relate to water treatment, such as constructed wetlands.
- Funding for pilot projects or use of incentives to study the reuse of treated industrial effluent and other waste-water sources
- Expanding the implementation of artificial recharge systems in appropriate locations, including site identification, construction and incorporating the use of renewable energy
- Support to increase the resilience of water intake works (infrastructures) located in sensitive watershed areas subjected to extreme weather conditions.
- Technical support to implement innovative methods/technologies such as early warning systems/probes to protect downstream assets from flooding

Natural Resource (terrestrial, coastal, and marine, biodiversity)

The rich biodiversity of the country is being threatened by climate change, but also is an important element of our adaptation response. From policy and planning measures to concrete interventions, various options for creating and sustaining healthy natural resources have been and are being pursued. Selected adaptation needs include the following:

- Increasing technical capacity and funding to sustain and expand ecosystem and wildlife habitat restoration programmes, including traditional engineered solutions and nature-based solutions
- Locally validated technical guidance for using nature-based solutions and comparing its costs and efficacy to traditional "hard" engineering solutions, as well as guidance on when and how to use hybrid systems - both hard and nature-based solutions in parallel.
- Conducting vulnerability assessments and modelling projected loss and damage, to inter alia, evaluate the feasibility of restoration and conservation interventions in various coastal areas.
- Technical and financial support to build capacity and ongoing education of fisherfolk and coastal community members to increase their involvement in mangrove and coral reef protection
- Funding for the implementation phase of the REDD+ initiative
- Technical assistance, financing, and technological development to support the inclusion of underrepresented groups (youth, women etc.) associated with gathering climate data for citizen science.
- Financing and technical support to expand the role of technology in monitoring post-disaster response, environmental management and enforcement.

Human Settlements and Infrastructure

Settlements and infrastructure are among the most affected by extreme events. One important adaptation measure in the past few years was the promulgation of building codes

which have resilience integrated as well as the recent Draft National Housing Policy (Green Paper) that supports and promotes sustainable and climate-resilient housing developments within the national climate change arena. Supporting this, is the training of sector specialists as well as various projects that aim to build the resilience of urban, rural and coastal communities. In 2022, Jamaica with the support of the Coalition of Climate Resilience Infrastructure (CCRI) partners, launched a Systemic Risk Assessment Tool (SRAT) to improve the integration of climate change in decision-making for infrastructure projects, particularly in vulnerable "hotspots". Nonetheless, this capital-intensive sector requires consistent maintenance, redesigns, and retrofits, in addition to:

- Ongoing technical support to develop a climate-resilient strategy for infrastructures that are culturally and historically valuable.
- Technical support to mainstream climate-resilient strategies, including water harvesting structures and innovative designs
- Financial and technical support to record archaeological sites which are threatened by climate change (including SLR) and resources to address the risks
- Financial and technical support for community-based capacity development, training, and planning.[22]
- Enhanced capacity of municipal councils to propose, monitor and assess community-level adaptation interventions and their impacts, in coordination with MDA partners.

Energy

The resilience and recovery capacity of the energy sector is central to national economic and social wellbeing. To establish an energy sector that is resilient in the face of climate change and climate variability, a comprehensive, data-driven, science-based, approach to climate risk identification, reduction, recovery, and restoration, must be adopted.

Progress has been made in assessing the levels of exposure, susceptibility, and risk of elements of the sector's energy generation, transmission, distribution, and storage infrastructure, to climate change and climate variability. This vulnerability and risk assessment is possible through the application of the SRAT. The national electricity company also pursues training, capacity development and emergency response and recovery. Despite progress and ongoing activities, needs remain, including:

- Technical and financial support to improve the location of electrical networks (production, transmission, distribution, and storage) against wind damage, storm surge and flooding (coastal and inland).
- Technical and financial support to explore and implement the appropriate design of energy facilities located along the coastline and susceptible to extreme events and SLR.
- Technical assistance to develop the methodological framework that will provide the enabling environment to facilitate adaptation projects/investment.
- Technical and financial support to explore the appropriate design of energy networks, to enhance resilience through the incorporation of renewable energy technology (RET) solutions, RET supported decentralisation, and diversification of energy supply and storage.
- Enhanced coordination of energy sector climate risk reduction initiatives with regional preparedness, response and recovery mechanisms.

[22] There have been various initiatives over the past ten years leading to the development of Community Disaster Risk Management Plans (https://www.odpem.org.jm/community-plans/). A community with high levels of awareness and sound knowledge on disaster preparedness and mitigation practice will play a significant role in managing and reducing injury and death, and socio-economic loss to the community.

Transportation

Efficient and reliable transportation is dependent on sufficient, structurally sound, infrastructure (roads, bridges and ports), that is protected by systems of secondary infrastructure (drains, culverts, retaining walls, etc.). The effectiveness of these protective systems is dependent on appropriate design, and the impacts of land-use practices in surrounding areas. Regardless of the scale of a disaster, transportation is central to effective response, recovery, and restoration efforts. Effective adaptation in the transportation sector requires coordinated action across several sectors. Several vulnerability assessments and public infrastructure improvements have taken place. Infrastructure designs and ecosystem-based adaptation recommendations based on hazard and vulnerability assessment studies have been developed under different initiatives. However, as a capital-intensive sector, the mobilization of financing has been constraining climate change adaptation efforts. Needs include, inter alia, the following:

- Conduct detailed, location-specific, climate vulnerability and risk assessments for each of Jamaica's main air and seaports, using the time-slices, and climate change projections employed in the State of the Climate Reporting process.
- Use the findings of the climate change and vulnerability and risk assessment to develop, cost, select, and implement adaptation options.
- Technical support to mainstream capacity-building efforts in disaster risk reduction and climate change adaptation across institutions
- Deploy the validated Jamaica Systemic Risk Assessment Tool (J-SRAT) as a shared platform for assessing and tracking, *inter alia*, transportation infrastructure exposure, and susceptibility to climate hazards.

Vulnerable Groups

It is essential that adaptation efforts are inclusive and informed by the needs of all stakeholders. This has been an underpinning aspect of adaptation efforts in Jamaica, but there is need for more sustained effort by organisations responsible for climate change adaptation, especially with respect to vulnerable groups. Jamaica has made strides in addressing the risk of climate change to vulnerable groups. This includes the collection of disaggregated data to capture gender disparities, the development of assessments to better inform policy and programme design towards addressing the concerns of climate change impacts on groups such as children, youth, the elderly, and persons with disabilities, as well as the piloting of early warning and emergency alert communication systems for persons with hearing and visual impairments.

Adaptation planning efforts require eliminating risks associated with residual exposure and the susceptibility of vulnerable groups (women, girls, youths, the elderly, persons with disabilities, and underrepresented groups) to extreme hydro-meteorological events. Their vulnerability is often due to their unique challenges not being reflected in national sectoral policies, legislation, and regulations on disaster risk reduction and climate change adaptation. Therefore, a National DRR/CCA strategy and roadmap for the elimination of residual risk and susceptibility of vulnerable groups to climate extremes, by 2030 is required. Other adaptation needs and/or priorities include:

Gender-Responsive Climate Change

- Technical support to mainstream awareness of gendered dimensions of CCA/DRR
- Technical support to explore appropriate ways to institutionalize gender-responsive approaches to CCA/DRR
- Technical support to mainstream accountability and transparency within the M&E framework for institutions implementing gender-responsive approaches to CCA/DRR
- Technical support to expand capacity-building efforts in CCA/DRR across institutions

Children, Youth and the Elderly

- Technical support to build awareness of youth, children and the elderly's vulnerability, needs, and safety with CCA/DRR planning efforts
- Technical and financial support to improve data gathering mechanisms and research repository on youth, children and the elderly to climate change issues
- Technical support to explore the best ways to expand the engagement of children, youth and the elderly in CCA/DRR, as well as building their resilience to climate risks.
- Technical support to explore the best ways to mobilize innovative financing mechanisms to target resilience-building efforts for youth, children and the elderly.

Persons with Disabilities

- Technical support to mainstream disability considerations throughout CCA/DRR planning and resilience-building efforts.
- Technical support to explore appropriate ways to expand awareness and access to CCA/DRR information for PWD.
- Technical and technological support to expand and improve early warning and emergency alert communication systems for PWD.
- Technical support to mainstream PWD appropriate operating protocols for infrastructures and first responders that support CCA/DRR efforts

Box 2: Adaptation Barriers and Gaps

Despite the progress made in mainstreaming climate change adaptation strategies and action plans, further advancements will require resolving various barriers and gaps relating to:

- Establishing a comprehensive central repository for accessing and archiving documents (project reports, research etc.) that can help in the sharing of knowledge and lessons and also accelerate the dissemination of climate information, vulnerability, and risk assessments, as well as multi-scalar adaptation initiatives.
- Increased capacity of local researchers specializing in climate science
- Sufficient socio-economic and environmental forecast based on climate projections or modelling scenarios (crop yields, coastal inundation, energy demand, freshwater availability, forest productivity etc.).
- Increase integration of climate change considerations into national financing mechanisms, public infrastructure, security plans, as well as sectoral enabling frameworks (policy and legislative frameworks and programmes.
- Greater participation of the private sector in climate adaptation initiatives, including a focus on:
  - Awareness and knowledge of climate risks;
  - Knowledge of mitigation and adaptation options; including hard (gray), nature-based (green) and soft (policy, legislation, human knowledge attitudes and practices) adaptation options.
  - Technical and financial capacity to implement;
  - Social attitudes toward mitigation and adaptation;

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