Immediate Climate Vulnerabilities: Climate Change and Planning Policy in Northern Communities

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Synonyms

Abrupt climate susceptibilities; Abrupt climate vulnerabilities; Rapid climate susceptibilities; Rapid climate vulnerabilities

Definitions

Abrupt or Rapid Climate Change

Abrupt, also referred to as rapid, climate change is the nonlinear application of expected climate forces that occur faster than anticipated, or the sudden occurrence of unexpected climate forces (Baede et al. 2014). These unexpected climate forces can have devastating effects for local communities, especially those on the coast (Birchall and Bonnett 2019, in review; Birchall 2019; Wallace 2017). While common coastal community climate change impacts such as sea level rise are more predictable in nature and can be monitored and prepared for over the long term, abrupt climate change impacts can be much more complex to predict, are highly localized (Sorensen et al. 2018), and often result in coastal communities resorting to reactionary measures in order to adapt.

Smaller communities are particularly vulnerable, as the majority of available resources for combatting abrupt climate change effects are often located in larger metropolitan centers, owing to their larger financial, professional, and academic capacity (Sorensen et al. 2018). Moreover, remote northern coastal communities, due to sparse populations and sensitive environmental locations, often lack adequate local resources to either proactively or reactively combat abrupt climate change, without significant external stakeholder collaboration (Sorensen et al. 2018).

Abrupt climate change impacts can manifest in a variety of different ways. In Homer, Alaska, for instance, storm surges and bluff erosion are the primary stressors. While environmental impacts are not new to the remote community, climate change is exacerbating their occurrence and magnitude.

A multidegree increase in seasonal temperatures has led to more severe storms coming off of the Pacific Ocean into Kachemak Bay. The larger wave action associated with these storms has wreaked havoc on Homer's fragile coastal infrastructure, with waves overtopping seawalls

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and undermining buildings, and debris blocking highways (Birchall and Bonnett in review).

A rise in intense precipitation, including winter rain (instead of snow) has also increased erosion and instability on the community's surrounding bluffs, where development is prominent; road collapse and property slumping have all become more common (Birchall 2019).

In Nome, Alaska, elevated temperatures present two key stressors: thawing permafrost and thinning sea ice. Like Homer, environmental change is not new to the community; however, with Arctic temperatures increasing faster than global mean (IPCC 2013), it is the rate of change that challenges community decision-makers in Nome.

Increased rates of permafrost thaw impact Nome in three main ways: building subsidence, utilities failure, and road undulation. While warming permafrost is a challenge during the summer months, thinning sea ice opens the community to greater risk during the cooler months (Birchall and Bonnett in review). Thinning sea ice affects the community primarily in two ways: a longer ice-free season and weaker sea ice, both resulting in increased exposure to storms and flooding (Birchall and Bonnett in review).

Like Homer and Nome, Alaska, Churchill, Manitoba, is experiencing abrupt climate change and as a result has become susceptible to immediate climate change-related vulnerabilities. The case of Churchill is expanded on throughout this entry.

Vulnerability

Vulnerability is the potential to be negatively impacted. A community's vulnerability can be a symptom of being sensitive or susceptible to endangerment and their lack of resources to respond or adapt to climate change impacts (Field 2014).

Immediate Climate Vulnerabilities in Relation to Communities

Communities' typically begin tackling risks to climate change by assessing and verifying their vulnerabilities through a vulnerability assessment or inventory approach. Assessing vulnerability through a climate change lens is not generally done through a city's existing disaster risk reduction (DRR) mechanisms but through separate channels from their own environmental departments, the mayor's office, or other institutions. Simply adding urban climate change adaptation on to existing DRR strategies may prove ineffective as DRR does not provide adequately long-term scope nor does it excel in taking change into account (Bulkeley and Tuts 2013).

Introduction

Coastal communities are becoming increasingly susceptible to immediate climate change-related vulnerabilities (Birchall and Bonnett in review). Decision-makers are left with the daunting challenge of developing appropriate policies and plans to bolster community resilience and adaptation. Northern coastal communities are especially vulnerable, and as temperatures rise, permafrost thaws and sea ice increases in variability, the natural and built environments become more susceptible to stress. The case of Churchill, Manitoba, Canada, is especially intriguing as the town is facing particularly rapid and acute climate vulnerabilities, including permafrost melt, unseasonal heavy precipitation and subsequent flooding, resulting in massive impacts on the town's local economy and environment.

Immediate Climate Vulnerabilities in Northern Coastal Communities

Northern coastal communities are situated in fragile ecosystems and are thus particularly vulnerable to the effects of climate change. The tundra is a harsh environment that requires unique local adaptations, but rising temperatures are now adding another level of variability. Infrastructure designed to function on permafrost and on seasonal frozen ground conditions is now increasingly jeopardized by rising temperatures (Nunavut Climate Change Centre n.d.). Communities fortunate enough to have winter road access are facing shorter shipping seasons due to longer, less reliable shoulder seasons while those with air access are frequently having to perform costly repairs on heaving runways (Sustainable

Development Province of Manitoba n.d.-b). Pipelines and facilities for water, energy, and waste systems are becoming increasingly susceptible to freeze-thaw cycles which push infrastructure beyond design limitations (Nunavut Climate Change Centre n.d.).

Traditional hunting, fishing, and gathering methods used by northern coastal communities are also being threatened by climate change. Longer shoulder seasons, unreliable winter sea-ice thickness, and increasingly difficult overland travel during the summer are all contributing to food insecurity and dependency on nonlocal resources (Nunavut Climate Change Centre n.d.).

The volatile nature of these climate vulnerabilities poses a unique challenge to regional and community planners. Creating land use policies and forecasting long-term infrastructure requirements that are sufficiently adaptable to withstand the myriad of issues that climate change poses is a daunting task. Though climate change adaptation is increasingly prevalent in Arctic governmental and institutional policy, planners still face barriers in implementing those policies on the ground (Ford et al. 2017). Those barriers can be attributed to a community's level of *adaptation readiness* or their ability to actually prepare for, create, execute, and reflect upon an adaptation (Ford et al. 2017; Ford and King 2015).

Adaptation readiness heavily relies on political champions, low rates of governmental and institutional turnover, interdepartmental coordination, and sufficient resources (Ford et al. 2017). Many northern coastal communities lack many or all of these attributes, struggling with political and administrative retention, disseminating information among various levels of government, and a lack of capacity to deal with climate change adaptation when they are already overburdened by urgent healthcare, unemployment, and poverty crises (Ford et al. 2017).

In Canada's case, the federal government and the territorial governments of the Yukon, Northwest Territories, and Nunavut have committed to improving Arctic resiliency initiatives and adaptation readiness through the creation of a Northern Adaptation Strategy (Ford et al. 2017). This strategy should make significant gains in improving adaptation readiness for Arctic coastal communities, but it does not encompass all northern coastal communities. The initiative is exclusive, to a certain extent, as it does not address sub-Arctic coastal communities outside of the territories that are also facing similar, if not more pressing, immediate climate change vulnerabilities.

Churchill, Manitoba, Canada: A Case Study

Importance and Key Issues

The town of Churchill, Manitoba, Canada, has experienced the effects of climate change more harshly than many communities in recent years. Located along a narrow peninsula between the barren tundra shoreline of Hudson Bay and the mouth of the Churchill River, changes in the town's ecological surroundings have jeopardized its physical/environmental and economic future, and present a challenge to land use and infrastructure planning in the region.

Churchill's economy depends on three pillars: tourism, transportation, and health care services (Montsion 2015). With a population of 899 (Statistics Canada 2016), eco-tourism is the town's main economic driver, but immediate climate vulnerabilities present a major cause for concern. Churchill is internationally recognized as the polar bear capital of the world, and the region has played a catalyzing role in climate change literature and discussion as a result. Sea ice variability caused by rising temperatures is endangering the local bear populations. Polar bears must wait longer for ice to freeze on Hudson Bay, and as a result, hunting for seals is made more difficult. Polar bears are thus becoming increasingly reliant on scavenging land-based food, which has increased the number of dangerous bear encounters in town (Wilder 2017). Further, the lack of a reliable food source is causing a rise in the mortality of cubs, threatening the species long-term viability in the region (Stirling and Derocher 2012; Derocher 1993).

The longer ice-free period is also affecting the local beluga whale population, another key player

in Churchill's eco-tourism economy. Rising water levels and changing weather patterns are affecting the behavior of the Western Hudson Bay beluga population, and a longer ice-free period has meant that killer whales are becoming established in Hudson Bay, endangering belugas that breed in the Seal, Churchill, and Nelson River estuaries (Smith et al. 2017).

The potential increase in activity from the Port of Churchill, due to an extended ice-free shipping season, has been identified as an additional climate change induced threat to the belugas (Government of Manitoba 2016). The Port of Churchill has long been dreamed of as an economic bastion for the town. Canada's only Arctic deep water port was built based on federal and provincial interest in creating a central continental north-south international trade route to Europe and Northern Asia, but despite repeated top-down attempts over the last century, the port and the associated Hudson Bay Railway have failed to live up to their potential. Federal interest in maintaining the port and railway waned, resulting in their sale to the privately owned OmniTRAX in 1997 (Montsion 2015). The dissolution of the Canadian Wheat Board's single desk model in 2012 further damaged the port's significance (Veeman and Veeman 2006).

Though the increased shipping season may benefit a repurposed Port of Churchill in the long-term, more immediate climate change effects have further stressed the port's economic viability. Overland flooding in the spring of 2017, a result of two unseasonably late winter storms with high snowfall and subsequent rapid snowmelt, washed out portions of the railway, the town's only permanent land link. Passenger rail services during peak beluga and polar bear season were cancelled and all supplies had to be flown in until a temporary winter road could be built, causing a steep rise in the cost of living (Hoye 2017). Thawing permafrost and the threat of future flooding make repairing and maintaining the rail line difficult, which has left little public or private sector will to restore the line to service. Further complicating the matter, the federal government and OmniTRAX have denied responsibility for the repairs and have filed lawsuits against one another to resolve the dispute, causing uncertainty surrounding any pending sales (CBC News 2018).

Local citizen transportation methods are also doing little to mitigate the effects of climate change on Churchill's infrastructure. Transportation options within Churchill are reflective of many northern Canadian communities in that Off-Highway Vehicles (OHV's) are primary modes of transport (Distasio 2011). These transportation methods contribute a disproportionately high amount of greenhouse gas (GHG) emissions in Canada (Government of Canada 2013) and are known to degrade ecologically sensitive ecosystems (Ouren et al. 2007).

Struggles in accessing traditional food sources in and around Churchill by OHV's could have long-term health impacts for the region. Restricted OHV travel caused by thawing permafrost and intensified spring runoff could result in food insecurity and increased dependence on less nutritious southern food shipments. This detachment from the land, paired with more frequent overland flooding events and subsequent railway wash outs, could contribute to mental health deteriorations associated with increased isolation and stress (Groulx et al. 2014; Cunsolo-Willox et al. 2012). These health impacts could affect the social well-being of the community and overburden the Churchill Health Centre (Nunavut Climate Change Centre n.d.).

Climate change could potentially impact property associated with the Churchill Health Centre and other major town institutions. Though sea level rise is expected to have minimal short-term impact on Churchill given that glacial-isostatic adjustment, or the movement of land caused by the retreat of glaciers (National Ocean Service 2017), is resulting in a prolonged topographic rise for the Churchill region (Wolf 2004), continued flood events similar to the one that devastated the rail line could directly impact town infrastructure in the near future. Rising temperatures are projected to increase the veracity of storms across Canada's north, causing coastal erosion that could require expensive adaptation measures in order to protect key buildings such as the health center (A Northern Vision n.d.). Thawing permafrost is also predicted to endanger underground infrastructure, limit where buildings can be

located and dictate how community expansion can take place (Nunavut Climate Change Centre n.d.).

All of the above climate change impacts represent significant challenges to land use and infrastructure planning in Churchill. Despite being aware of these challenges, and recognizing that climate change is directly impacting the well-being of the species that dominates their economy and way of life, residents are still relatively disengaged and inactive in municipal climate change discourse (Groulx et al. 2014). This lack of engagement has been attributed to a failure to create a socially salient message. The approach to climate change education has been primarily academic and therefore often misses the opportunity to garner community buy-in by integrating social interactions with the effects of climate change (Groulx et al. 2014).

Incorporating climate change into land use and infrastructure planning in Churchill is complicated by the number of stakeholders and differing jurisdictional structures involved. Historically, the divide between federal, provincial, and private land interests surrounding the town site has been vague (Sustainable Development Province of Manitoba n.d.-a). The town site itself also has a disproportionate number of provincially owned housing, recreation and health services buildings in comparison to private and municipal structures (Distasio 2011). This muddling of jurisdictional authority weakens Churchill's adaptive readiness since many adaptations to immediate climate change vulnerabilities rely on cooperation from multiple levels of government and private interests. Unsuccessful collaboration results in a failure to keep climate change adaptation at the forefront of land use and planning discussions, as evidenced by the current port and railway dispute.

Future Directions

At the municipal level, Churchill has taken steps to combat the immediate effects of climate change, including the creation of Churchill's Sustainability Planning Framework (CSPF). Conducted in 2011 by the University of Winnipeg's Institute of Urban Studies, the CSPF creates a long-term vision for Churchill's future based around six key integrated priority areas: food security, economic development, youth education, training, and recreation, waste management, housing, and built environment. The CSPF directly recognizes Churchill's climate change vulnerabilities in terms of economic development, waste management, and built environment priorities and recommends that Churchill create a long-term climate change and adaptation and mitigation approach that is synchronized with every aspect of future planning (Distasio 2011).

The creation of the CSPF follows a common trend noted by climate change adaptation literature: that the creation of a vulnerability and hazards assessment is only the first material step a municipality can take towards meaningful climate change adaptation action (Stults and Woodruff 2017; Berrang-Ford et al. 2011; Eakin and Luers 2006; Maru et al. 2011; Smit and Wandel 2006). The CSPF is typical of other localized climate change assessment documents in that it reads more as a symbolic *intention to act* rather than a detailed outline of planned actions and how to successfully implement and measure them (Stults and Woodruff 2017; Berrang-Ford et al. 2011; Birchall and Bonnett in review). Focusing on the assessment aspect of climate change adaptation is understandable, especially considering the significantly larger emphasis that academic and gray literature have placed on the topic, judged by the drastically greater number of publications, compared to literature on climate change implementation and actions (Stults and Woodruff 2017; Stults et al. 2015). This tendency is reflected in the scholarly climate change research at Churchill's Northern Studies Centre (CNSC). The CNSC directs the vast majority of its attention on Churchill's vulnerable and unique ecological environment (Churchill Northern Studies Centre n.d.) rather than on the effects of climate change on the town's residents and infrastructure. The bias in local research provides insight as to why a place so commonly associated with sustainability and environmentalism is only at the preliminary stages of its own climate change planning policies.

The lack of integration between climate change adaptation literature's language and structure and a community's existing land use and

infrastructure risk management mechanisms (Gibbs 2015) may be contributing to climate change adaptation actions not being explicitly mentioned in the Town of Churchill's existing documentation. Gibbs (2015) suggests that instead of creating brand new, climate change specific actions, municipalities should build climate change actions into their established infrastructure and maintenance practices. For instance, the Town of Churchill and OmniTRAX may already be utilizing infrastructure building and maintenance practices in their day-to-day operations that successfully address certain immediate climate change vulnerability challenges such as permafrost thaw to some extent. If so, future climate change adaptation actions regarding permafrost thaw could use those existing practices as building blocks, increasing the likelihood of those future actions being implemented since they were born from policy that is already being acted upon.

The actual creation and implementation of any adaptations or strategies stemming from the CSPF may also be hindered by a lack of political will. Though the CSPF was created through community consultation and had significant local public support (Distasio 2011), the future of the Hudson Bay Railway and Port of Churchill is partially out of the community's hands. As Montsion (2015) states, if Churchill is to be thought of as a port community first and foremost, then the continuous decrease in the town's population and economic prospects can be attributed to the port's underutilization and the absence of a coordinated local economic development effort among the key government, private sector, and community stakeholders.

Assuming the railway and port are sold and repaired, significant future investment will still be required to retrofit the port to handle goods other than grain. Municipal and provincial stakeholders have lobbied the federal government to support the Arctic Gateway corridor, a proposed economic gateway connecting the Foreign Trade Zone and multimodal cargo transportation hub of CentrePort in Winnipeg (CentrePort Canada 2018), and the Ports of Churchill and Iqaluit, to European and Russian ports across the Arctic Circle (Montsion 2015). A federal commitment to promote Arctic Gateway under their National Policy Framework for Strategic Gateways and Trade Corridors would catalyze public and private infrastructure investment in Churchill and the surrounding region, allowing the Port of Churchill and Hudson Bay Railway to diversify.

Unfortunately, lobbying efforts to date have failed to achieve federal backing due to the federal government's assertion that funding is lacking, and their expectation that the current National Policy Framework would have to be significantly modified in order to include indigenous key actors and policy frameworks that are unique to the Arctic (Parliamentary Information and Research Service 2011). This lack of funding commitment may also be due to the federal government no longer seeing Churchill as "northern" *enough*, instead focusing on communities above the 60th parallel (Montsion 2015).

The erosion of the Churchill Health Centre's status as the main health hub for the region is a prominent example of the town's declining influence among its Arctic counterparts. The upgrading of healthcare services in Rankin Inlet, the administrative center of Nunavut's neighboring Kivalliq Region, has created a significant reduction in the number of patients needing to be flown to Churchill for care (Robertson 2017). Though more localized delivery of health care services in Nunavut is a positive development for Kivalliq residents (Montsion 2015), it has caused the short term underutilization of the Churchill Health Centre in some health disciplines and is resulting in residents needing to flown to the other healthcare hubs in Manitoba for services such as childbirth (Robertson 2017).

Adaptation to Churchill's climate change challenges will require a transformative shift in how current planning policy is funded and adopted. Opening up different channels for discussion and bringing in new institutions to create a more sustainable funding model (Bulkeley and Tuts 2013) could be a key to effectively implementing existing policies such as the CSPF and achieving federal recognition the Arctic Gateway corridor.

The environmental, economic, and physical effects of immediate climate change need to be addressed and acted upon to ensure the long-term viability of Churchill, and its surrounding

ecosystem. Churchill's experience is becoming increasingly common throughout northern coastal communities around the world, and planners can assist these communities by ensuring that these vulnerabilities are measured and accounted for in land use policies and infrastructure assessments.

Cross-References

- Climate Change Adaptation (CCA)
- Climate Change Impacts and Resilience: An Arctic Case Study
- Climate Change Planning: Understanding Policy Frameworks and Financial Mechanisms for Disaster Relief
- Community Planning Opportunities
- Making Communities Resilient to Global Climate Change
- Vulnerability
- Vulnerable Communities: The Need for Local-Scale Climate Change Adaptation Planning

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Impacts

▶ Climate Change, Multiple Stressors, and Responses of Marine Biota

Interactive Planning

▶ Community Planning Opportunities: Building Resilience to Climate Variability Using Coastal Naturalization

Intermediate Cities

▶ Climate-Resilient Cities in Latin America

Interventions for Managing Disaster Risk Assessment and Climate Adaptation in The Bahamas

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Definitions

The United Nations Development Programme (UNDP) (2010) defines **risk** as "the probability of harmful consequences – casualties, damaged property, lost livelihoods, disrupted economic activity, and damage to the environment – resulting from interactions between natural or human-induced hazards and vulnerable conditions."

Further, UNDP defines **risk assessment** as "a process to determine the nature and extent of such risk, by analyzing hazards and evaluating existing conditions of vulnerability that together could potentially harm exposed people, property, services, livelihoods and the environment on which they depend." With the intense variability of climate that is experienced globally, it is critical for all nations to engage in a comprehensive risk assessment to evaluate the magnitude and likelihood of losses and understand the impact and causes of those losses.

This risk assessment also includes **climate adaptation**, which is defined by the European Union (2018) as "Anticipating the adverse effects of climate change and taking appropriate action to prevent or minimise the damage they can cause, or taking advantage of opportunities that may arise." Thus, climate adaptation is crucial for affected countries to be able to adjust to climate change, moderate potential damage, and cope with the consequences (Global Greenhouse Warming 2018). According to the International Panel on Climate Change (IPCC) (2018), climate adaptation is the way forward in the adjustment in natural or human systems to a new or changing environment. Hence, the ability of humans to adapt to the variability in the climate is critical.

Tackling global phenomena like climate change requires well-coordinated partnerships with all stakeholders – nationally and internationally. Pooling all resources in terms of technology, capacity, and funding is important to determine the best interventions for managing disaster risk assessment and climate adaptation. Hence, policy interventions in the form of government strategies and public–private partnerships are crucial for managing disaster risk assessment and climate adaptation in countries which are susceptible to natural disasters, especially those in the Caribbean and the Pacific.

The Bahamas, an archipelagic nation and a **Small Island Developing State (SIDS)** of the Caribbean, has adopted and adapted sound intervention mechanisms. SIDS are "maritime countries that tend to share similar sustainable development challenges, including small but growing populations, limited resources, remoteness, susceptibility to natural disasters, vulnerability to external shocks, excessive dependence on international trade, and fragile environments" (UNMGCY 2018).

Introduction

Over the past years, human-induced climate change has continued to exacerbate the risk of major damage across the globe, especially in Small Island Developing States (SIDS). This damage directly impacts the livability of humans, threatens wildlife, wipes out vegetation, results in the destructive alteration of the polar region, coral bleaching, and loss of land areas below sea level. As a result, SIDS are experiencing increased ocean heat content and higher sea surface temperatures which invigorate tropical cyclones, making them more intense, larger, and longer lasting. For example, SIDS, especially those in the Caribbean, experienced a higher frequency and intensity of hurricanes in 2017 compared to the previous

years. This greatly increases the propensity for floods and threatens the very existence of some islands as they are exposed to sea level rise, coastal erosion, and changes in habitats (Intergovernmental Panel on Climate Change, IPCC 2014; Trenberth et al. 2018).

With increased greenhouse gases (GHG) such as carbon dioxide in the atmosphere, the global climate is rapidly changing. According to Lee (2018), during the 2018 summer season, many countries experienced record-breaking heatwaves and deadly wildfires owing to this change in climate. Further, the Global Carbon Project (GCP), a Global Research Project of Future Earth and a research partner of the World Climate Research Programme (Global Research Project 2019), integrated the knowledge of greenhouse gases for human activities and the earth system. As a result of this project, it was further estimated that, from 2017 to 2018, the world carbon dioxide emissions rose 2.7%. The 2018 studies further established that the world will spew 40.9 billion tons (37.1 billion metric tons) of carbon dioxide, up from 39.8 billion tons (36.2 billion metric tons) in the year before.

As a result of these risks, SIDS are likely be the first to face the loss of adaptive capacity and ecosystem services; increased sea level rise and coastal inundation in low-lying areas on islands and atolls; as well as sea surface temperature rise resulting in increased coral bleaching and reef degradation (United Nations Department of Economic and Social Affairs, UNDESA 2014). Consequently, the residents of SIDS will be vulnerable to loss of livelihood, food migration, and food insecurity due to climate change (Turvey 2007). The island communities in most SIDS are dependent on coral reef ecosystems for coastal protection, the fisheries industry, and tourism. Owing to this, the risk created by climate change will have multiple social, economic, and environmental impacts. Thus, interventions for managing disaster risk assessment and climate adaptation is critical in SIDS.

Small Island Developing States (SIDS)

Sustainable Development Goal 13 urges nations to take immediate action to combat climate change and its impact. As indicated by the United Nations Educational, Scientific and Cultural Organization in the Small Island Developing States (SIDS) Action Plan (UNESCO 2016), "The future of the planet depends, to a large extent, on the sustainability of the SIDS." The SIDS are at the forefront of the climate change impact. Hence, all SIDS must have an intervention mechanism to manage disaster risk assessment and climate adaptation. SIDS are spread primarily throughout the Caribbean, Pacific, and in the African, Indian Ocean, Mediterranean, and South China Sea (see Table 1).

There are more than 50 island countries and territories across the globe that are part of SIDS. With a combined population of more than 50 million, these SIDS are home to 0.625% of the world's population. As indicated by Nair (2018), tourism contributes more than 40% of the gross domestic product (GDP) of SIDS with agriculture contributing less than 20%. Addressing environmental sustainability is critical as SIDS are impacted by climate change, are vulnerable to sea level rise, and are susceptible to natural disasters like hurricanes and tropical storms. Without proper interventions to mitigate these impacts at the national and regional level, the economy of SIDS may be stunted by climate change.

The impact of climate change in SIDS, especially in "warm-water island destinations," may be different. According to McLeod and Croes (2018), "Warm-water islands are a cohesive group of islands, distinguished by their geography and remoteness, history as former colonial territories, and dependence on external stakeholders for their economic and social development," and "they are located between the Tropic of Cancer and the Tropic of Capricorn at 23.5° north and south of the equator respectively." The Caribbean, the Indian Ocean, and the Pacific islands all fall within this tropical zone. The Bahamas is a warm-water small island destination which faces challenges similar to all other SIDS with respect to managing the severe impact of climate change.

The Archipelagic Bahamas

The archipelago of The Commonwealth of The Bahamas is spread over 100,000 square miles of

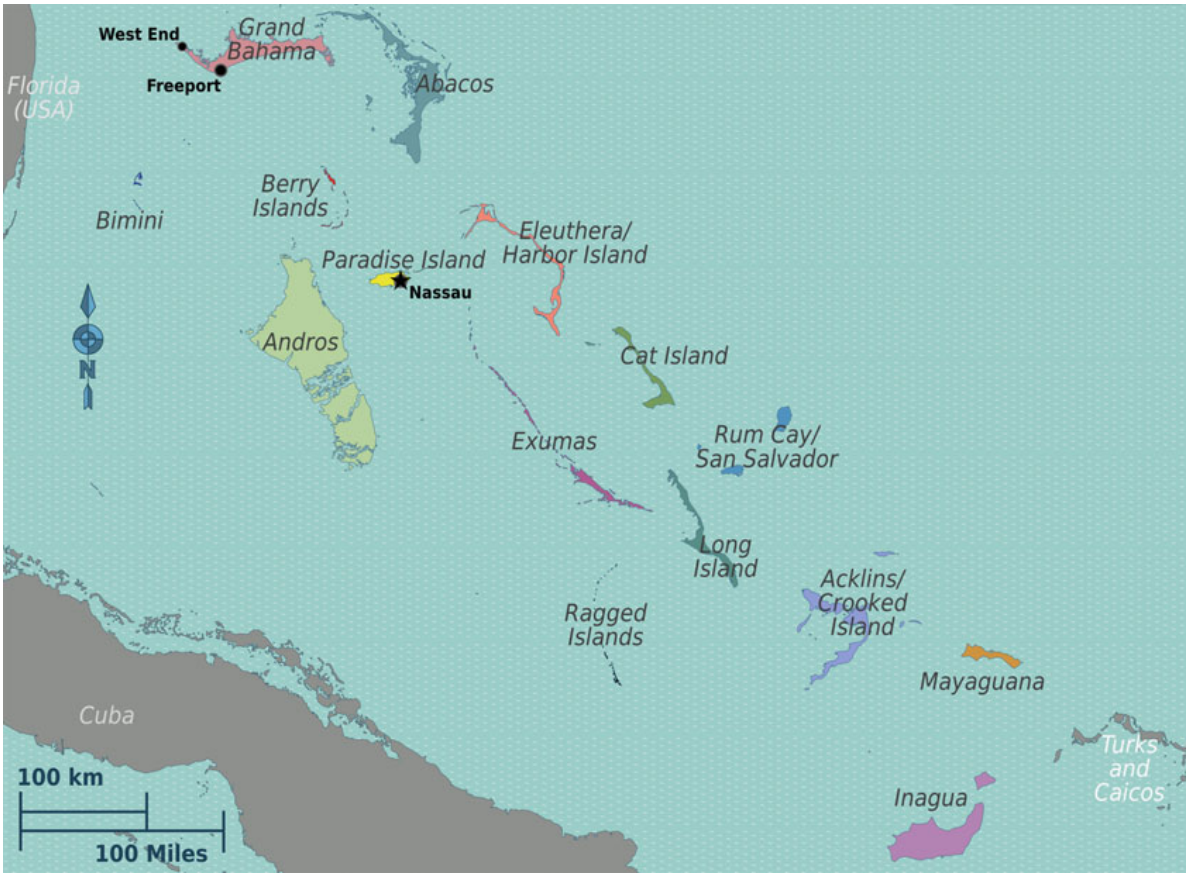
Interventions for Managing Disaster Risk Assessment and Climate Adaptation in The Bahamas, Table 1 Small Island Developing States (SIDS)

Caribbean	Pacific	African, Indian Ocean, Mediterranean, and South China Sea
Anguilla	American Samoa	Cape Verde
Antigua and Barbuda	Cook Islands	Comoros
Aruba	Federated States of Micronesia	Guinea-Bissau
Bahamas	Fiji	Maldives
Barbados	French Polynesia	Mauritius
Belize	Guam	Sao Tome and Principe
British Virgin Islands	Kiribati	Seychelles
Cuba	Marshall Islands	
Dominica	Nauru	
Dominican Republic	New Caledonia	
Grenada	Niue	
Guyana	Northern Mariana Islands	
Haiti	Palau	
Jamaica	Papua New Guinea	
Montserrat	Samoa	
Netherlands Antilles	Solomon Islands	
Puerto Rico	Timor-Leste	
Saint Kitts and Nevis	Tonga	
Saint Lucia	Tuvalu	
Saint Vincent & the Grenadines	Vanuatu	
Suriname		
Trinidad and Tobago		
United States Virgin Islands		

ocean. It comprises 700 low-elevation islands and over 2,000 rocks and cays in the West Atlantic, southeast of the coast of Florida, the USA, and northeast of Cuba. Generally, The Bahamas lies on a submarine shelf which rises steeply from deep waters in the east; to the west lies the shallow waters of the Great Bahama Bank. Most of the islands are low-lying and are built of coralline limestone to an undersea depth of about 1,500 m. The highest elevation, located on Cat Island, rises to 62 m at the settlement of Mount Alvernia. The limestone rock of the islands is permeable and there are no rivers or streams. Thus, the fresh water supply is taken from wells collected from rainwater catchment systems or is produced by reverse osmosis.

As documented by the Commonwealth Secretariat (2018), the climate in The Bahamas is more pleasant than other countries in the Caribbean, with winter temperatures averaging 21 °C and soaring to 30 °C in the summer. Most of the rainfall (averaging 1,100 mm p.a.) occurs May to June and September to October with frequent thunderstorms in summer. The islands of The Bahamas are subject to intense hurricanes June to November. About 29 islands are fully inhabited. Nassau, the capital, on the island of New Providence, which is in the middle of the grouping, and Freeport, on Grand Bahama which is one of the northernmost islands, are two of the highest populated islands with more than 70% and 15% of the population respectively. The other islands are known collectively as the Family Islands and were historically coined The Out Islands (see Fig. 1).

As in any of the SIDS, the potential impact of climate change on The Bahamas is worrying. This is especially so due to the economic reliance on international tourism and foreign investment along with the concentration of population and infrastructure along the coast (Scott et al. 2012; Thomas 2012). Benjamin and Thomas (2016) further add that inadequate human and economic resources are hindering the country's adaptation to climate change impacts and may result in limits to adaptation and permanent loss and damage. Hence, The Bahamas is regarded as among the most vulnerable countries in the world when it comes to the impact of climate change (Thomas and Benjamain 2018; McGranahan et al. 2007; Dasgupta et al. 2009). Managing disaster risk assessment and climate adaptation in The Bahamas is crucial for the survival of this country for generations to come.



Interventions for Managing Disaster Risk Assessment and Climate Adaptation in The Bahamas, Fig. 1 The Bahamas archipelago. (© With permission from https://commons.wikimedia.org/wiki/File:Bahamas_regions_map.png)

Risk Assessment

As described in the previous section, the geographical features of The Bahamas, that is low-lying and archipelagic, pose great risk and vulnerability to the major impacts of climate change. According to the Economic Commission for Latin America and the Caribbean (ECLAC) (2011), if the projected sea level rise is reached by 2050, between 10% and 12% of the archipelago will be lost. This will be even more critical in coastal zones where the main tourism assets of the country are located. Further, it is reported that the country will also be impacted if flight carbon emission taxes are established in the main source markets, representing an economic threat to the tourism sector of the islands. Hence, the impact of climate change on the primary tourism demand variables will pose a major risk to the economy that is so heavily dependent on tourism.

The risk from the ever increasing tropical cyclones in the Atlantic is another concern on the rising mean sea level. ECLAC estimates that the amount of losses can be in excess of US$2400 million for the period up to 2050. During the same period, total estimated impacts of progressive climate change are between USD$17 and USD$19 billion. The 2017 Atlantic hurricane season was one of the most active seasons on record; since 1851, this was the most ruthlessly deadly and extremely destructive season (Kelleher 2018). In a typical year, 12 named storms, 6 hurricanes, and 3 major hurricanes tend to be the norm. Nonetheless, as the impact of climate change hit the region, 2017 resulted in 17 named storms, 10 hurricanes, and 6 major hurricanes (Trenberth et al. 2018). Although the forecasted warm El Niño should have lowered storm activities, La Niña developed instead, creating more cool-neutral

conditions in 2017. Thus, a risk assessment is essential for comprehending how the season will unfold from year to year.

Based on the 2010 census (Department of Statistics The Bahamas 2015), the population of The Bahamas is 351,500. As a result of this relatively small population, there is a low growth in Greenhouse Gas (GHG) emissions and very little incentive to lower emissions in the future. Owing to this, there is a lack of seriousness and urgency to develop renewable energy systems in the country. Nonetheless, the rise in fossil fuel energy costs may speed up the need to produce alternative forms of energy.

The Bahamas has established a series of interventions to manage disaster risk assessment and climate adaptation. Numerous institutions and organizations manage climate-related issues and have developed action plans and measures to mitigate the risk. Nonetheless, coordination and collaboration with international agencies is lacking and needs to be enhanced in order to develop more adaptation and mitigation programs.

Interventions for Managing Disaster Risk Assessment

Aligning National Development Plans and Sustainable Development Goals

The Draft National Development Plan (NDP), Vision 2040 (Office of Prime Minister 2017) of The Bahamas, provides a roadmap for the future development of the nation. The plan has been guided by extensive research, analysis, and widespread public consultation aimed at addressing four main policy pillars – Governance, Human Capital, the Economy, and the Environment (natural and built).

On September 25, 2015, the Government of The Bahamas adopted the 2030 Agenda for Sustainable Development Goals (SDGs); one of the aims was tackling climate change. These goals were incorporated in the country's NDP. SDG 13 for climate action was well aligned with the environment pillar of the NDP (see Table 2).

Strategy 11.1 of the NDP, "Researching and Implementing Climate Change Adaptation and Mitigation Measures," is well aligned with SDG13.1 to SDG13.3. As indicated in the NDP, The Bahamas is highly vulnerable to the impact of climate change given its geographical vulnerabilities (limited land masses, low-relief, and dispersion of islands) and environmental vulnerabilities (high temperatures, storm surges, sea level rise, flooding, increased tropical storm activity, and rising water tables). Climate change research and the implementation of adaptation measures will help mitigate against climate change risks.

The Bahamas committed to reducing Greenhouse Gas (GHG) emissions via the Intended Nationally Determined Contribution (INDC) under the United Nations Framework Convention on Climate Change (UNFCCC) in 2015 by increasing the amount of energy generated from renewable sources. Although there is little The Bahamas can do to change world GHG, it can open its doors to international partners in academia, donors, not-for-profit, and nongovernment organizations and businesses to become a ground zero for new technology to adapt to the effects of climate change.

The following risk assessment was identified for this strategy:

1. Sole focus on adaptation measures which are reactive and short-term (coping strategies).
2. Technological barriers which lead to inaccurate climate change information due to, for example, limitations in modelling the climate system or lack of accurate weather forecasts.
3. Budget constraints which present a barrier when adaptation measures involve high upfront costs.
4. Social barriers: ethics (how and what people value), knowledge (how and what people know), risk (how and what people perceive), and culture (how people live).
5. Erosion of social cohesion and collective practices in communities has the potential to constrain adaptive capacity.
6. Lack of integration of dynamic pressures such as climate risk-induced migration, rapid urbanization, and population growth into national adaptation policies/strategies.

Interventions for Managing Disaster Risk Assessment and Climate Adaptation in The Bahamas, Table 2 Alignment of SDG13 with associate NDP strategies and goals

SDG priority targets	Associated NDP goals and action numbers	
SDG13.1: Strengthen resilience and adaptive capacity to climate-related hazards and natural disasters in all countries	**Strategy 11.1**: Researching and implementing climate change adaptation and mitigation measures	**Goal 11.1.1**: Invest in science, technology, innovation, and research on climate change **Goal 11.1.3**: Incorporate gender perspectives
SDG13.2: Integrate climate change measures into national policies, strategies, and planning		**Goal 11.1.2**: Incorporate climate change adaptation and mitigation measures into public education, planning, and budgetary processes
SDG13.3: Improve education, awareness-raising, and human and institutional capacity on climate change mitigation, adaptation, impact reduction, and early warning		**Goal 11.1.2**: Incorporate climate change adaptation and mitigation measures into public education, planning, and budgetary processes
SDG13.b: Promote mechanisms for raising capacity for effective climate change-related planning and management in least developed countries and Small Island Developing States, including focusing on women, youth, and local and marginalized communities	**Strategy 11.2**: Integrate disaster risk reduction in development policies	**Goal 11.2.1**: Incorporate comprehensive disaster risk management strategies for disaster response **Goal 11.2.2**: Strengthen land use policies and legislation **Goal 11.2.3**: Further strengthen early warning and evacuation systems and procedures **Goal 11.2.4**: Strengthen other pre-disaster responses **Goal 11.2.5**: Strengthen post disaster responses **Goal 11.2.6**: Build national and local technical staff capacity in disaster management, data management, and in the generation of environmental vulnerability assessments

7. Limited capacity of government officials to engage in climate diplomacy at the international level.
8. Lack of focus on the adaptive capacity needs of local government or island communities in formal adaptation efforts.

Under this strategy, the following indicators of success were determined:

1. Increase in research and development in climate change.
2. Eighty percent increase in family islands with climate change adaptation plans by 2025.
3. Seventy percent increase in homes using alternative energy sources by 2025.
4. Increase in the number of partnerships with leading green technology firms to build institutional capacity in green technology.
5. Forty-five percent increase in green foreign direct investment flows by 2025.
6. Fifty percent increase in share of renewable energy in total energy consumption.

Strategy 11.2, "Integrate Disaster Risk Reduction in Development Policies," is aligned with SDG13.b. Disaster loss is on the rise with grave consequences for the survival, dignity, and livelihood of individuals particularly the poor. The following risk assessment was identified for this strategy:

1. Poor communication and coordination between various tiers of government.
2. Inaccurate weather forecasts.
3. Limited engagement of disaster agencies with communities pre- and post-disasters.
4. Root causes of vulnerability are not being addressed through current formal adaptation efforts.

The following indicators of success were determined for this strategy:

1. Increase in the useful life of homes and buildings.
2. Decrease in the number of people displaced by disasters.
3. Less overall cost of rehabilitation following severe storms and hurricanes.
4. Increase in number of insured homes on the family islands.
5. Improved pre- and post-disaster responses.
6. Resilient communities.

In short, NDP Goal 11.2 focuses on supporting SDG13 by positioning The Bahamas as a leader in researching and implementing climate change adaptation and mitigation measures and as an incubator of green technologies (Goal 11.1). The Bahamas must also integrate disaster risk reduction into sustainable development policies and planning and build resilience to hazards (Goal 11.2). Only then can the nation combat climate change and the resulting natural disasters such as hurricanes and tropical storms.

Paris Agreement

The 2015 Paris Agreement, which is now ratified by 184 countries, sets out a global plan to limit global warming. The Government of The Bahamas committed to implementing the Paris Agreement on November 4, 2016. The ratification and implementation of the Agreement was critical as the nation moves forward in the fight against climate change. As the Agreement is now in full effect, the country is obligated to curb its carbon emissions in order to limit global warming to well below 2 °C above preindustrial levels and to pursue efforts to limit the temperature increase even further to 1.5 °C (Ministry of Housing and Environment 2018). As a small nation, it is critical for The Bahamas to work closely with CARICOM partners to comply with the Agreement (Dupuch 2018). Coordinating protective measures on a regional basis in facing the likely long-term risks and, at the same time, developing more effectively alternative renewable energy sources like wind and solar power, is the way forward for the nation.

National Emergency Management Agency (NEMA)

To continue to build an adaptive and resilient nation, The Bahamas streamlined climate change measures into national policies, strategies, and planning. The National Emergency Management Agency (NEMA) was established in 2006 through the National Disaster Preparedness and Response Act. NEMA is responsible for disaster preparedness and response policies, emergency operation centers, shelter management, identification of and precautionary planning for vulnerable areas, disaster alerts, and hazard inspections. As the nation experienced a series of massive hurricanes over past few decades, a more comprehensive disaster risk management strategy has been developed. This includes six steps, four of which are pre-disaster phases (namely risk identification, mitigation, risk transfer, and preparedness) and two are post-disaster phases (emergency response, and rehabilitation and reconstruction).

Under NEMA, the Disaster Management Committee, comprising representatives from relevant Government Ministries and Departments and the private sector, meets once a month throughout the year to discuss ways to mitigate the impact of disasters, especially hurricanes (Office of Prime Minister 2011). The Committee provides regular updates on preparing for hurricanes, tropical storms, and other disasters. As the intensity and frequency of these storms have increased, NEMA continuously takes early measures to ensure properties have sufficient shutters to reduce the amount of loss during a hurricane or tropical storm. Further, as part of managing the

risk, NEMA also ensures there is an adequate stock of canned foods and water, way before the landfall of the hurricane or storm. NEMA also is responsible for working with all other government agencies to coordinate programs to assist the victims of the disaster. This includes the distribution of emergency supplies, distribution of building materials, with duty exemptions on the importation of replacement items, and the reconstruction of houses for senior citizens and destitute persons.

Interventions for Disaster Risk Assessment and Climate Adaptation

National Policies and Initiatives on Environment and Climate Change

The Government of The Bahamas is committed to addressing issues surrounding climate change as it continuously receives regional and international support. The Government is conscious of the urgent need to protect the fragile environment and ecosystems of the country. Hence, in 1994 the Bahamas Environment Science and Technology (BEST) Commission was established to work closely with various agencies to achieve the country's goals of a comprehensive system of environmental management by managing the implementation of multilateral environmental agreements. BEST reviews environmental impact assessments (EIA) and environmental management plans (EMP) for development projects within The Bahamas (BEST Commission 2016).

In 1996, the National Climate Change Committee (NCCC) was established as part of the country's obligations under Article 4 and 12 of the United Nations Framework for Climate Change (UNFCC). NCCC was established as a subcommittee of BEST.

The Government of The Bahamas developed the National Policy for Adaptation to Climate Change in 2005. The policy's main aim was to adapt key actions that are needed to address climate change in various sectors in the country. The policy also aims to promote the development of public policies to fight climate change in The Bahamas. In support of the policy, a group of experts, adjunct professors of University of The Bahamas, established the Climate Change Initiative (CCI) to conduct research on climate change in the Caribbean. The current work themes of the CCI include climate-induced displacement and migration, management strategies for loss and damage in small island states, as well as the impact of international agreements on both the Pacific and Caribbean (Climate Change Initiative 2018).

Minister of the Environment and Housing

The Minister of the Environment and Housing of The Bahamas, through the Bahamas Climate Change Unit, has provided leadership in managing the risk of climate change via a number of initiatives. Legislation, policies, and programs have been tabled and passed to ensure the country is contributing toward the reduction of emissions. The Bahamas has reduced and/or eliminated tariffs on solar systems and energy efficient appliances to encourage the consumption of clean energy (Ministry of Environment & Housing 2018). In addition, through the Ministry, The Bahamas has joined international organizations that focus on increasing the use of renewable energy, including the International Renewable Energy Agency and the Carbon War Room, with the aim of advancing a "low carbon economy" in the form of renewable initiatives, including expansive photovoltaic systems across the Family Islands.

Bahamas National Trust

The climate adaptation needs that require an ecosystem-based adaptation are addressed by the Bahamas National Trust (BNT). With the changing climate, it was critical for The Bahamas to ensure its ecosystems are well protected, managed, and healthy. A total of 32 national parks, with over 2.2 million acres of protected land and sea, are managed by BNT (Bahamas National Trust 2018). In addition, BNT is working with the Government and other partners to establish additional protected areas; research and monitor the areas using species identified as sensitive to climate change; develop climate-smart management plans; enforce management strategies; restore areas as needed; and adapt the plan as circumstances change. The BNT will also be developing policy to assist with reducing human

activities that exacerbate the impacts of climate change for consideration by the government (Government of The Bahamas 2018).

National Emergency Warning System

In 2017, The Government of The Bahamas launched a pilot emergency/early warning system to further build the resilience of residents during natural disasters. This system allows NEMA, the Royal Bahamas Police Force, the Department of Meteorology, and Bahamas Information Services to disseminate emergency and informative alerts to residents and visitors via SMS, email, and social media platforms. The pilot system, and the subsequent consideration of a long-term solution, aims to increase access to information, particularly through the use of information and communication technologies, to help reduce the population's exposure to environmental, economic, and social disasters (Government of The Bahamas 2018). Nonetheless, the "Alert Bahamas" pilot system ended in December 2017 after a satisfaction survey was carried out by the service provider. The full report of the survey was made available (Unified Messaging Systems Americas 2017).

Hurricane Tracking in The Bahamas

Data from the National Hurricane Centre based in the USA guide the Bahamas Meteorology Department which uses a map to track and plot storm movements in the region and the archipelago. An early warning system is in place. It is linked to satellites that record the formation of storms and then tracks them accordingly. As the storm moves within the 500-mile (approximately 800 kms) range, the emergency plans set by NEMA are reviewed to ensure that all possible preparations have been made. The following "words of warning" are issued by the Bahamas Meteorology Department in coordination with NEMA and the National Hurricane Centre (US Department of Commerce National Oceanic and Atmospheric Administration 2018):

- Tropical Depression – a weather front with sustained winds of less than 39 mph (63 kmph).
- Tropical Storm – a cyclone where winds range from 39 to 73 mph (118 kmph).
- Hurricane – a tropical cyclone with winds of 74 mps (120 kmph) or more. Torrential rains and destructive waves known as storm surge may create flood conditions in coastal and low-lying areas.

The Bahamas Meteorology Department begins to issue series of advisories, watches, and warnings when a tropical depression forms. They include:

- Hurricane Watch – declared if winds are expected to reach the island within 48 h.
- Hurricane Warning – declared when dangerous conditions are expected to affect the islands.

Further, NEMA regularly updates the "Family Disaster Supplies Kit" for residents in preparation for all disasters that can happen due to the impact of climate change or other catastrophes (see Table 3).

Finally, the American Red Cross launched the Multi-Hazard App (American Red Cross 2018), a tool that will enhance communication and coordination to prepare and respond to multiple disasters in the region. The application includes features such as a one-touch "we're safe" button, a flashlight tool, advice, tracking the storm as it progresses, and all the local alerts. The app provides guides on the many precautions people can take and simple strategies they can employ to lessen the danger.

Challenges Faced in Implementing SDG13 Programs

As mentioned previously, SDG13 is a call for global action on climate change and its effects. Within the NDP, Goal 11 deals with the recommendations for climate change, natural disasters, and resilience. The Government of The Bahamas recognizes that the integration of disaster risk reduction into sustainable development policies and planning is critical to build resistance to natural hazards. The country needs to overcome the challenges of managing and using natural resources sustainably, while guarding against the negative impacts of human activity on the environment, unsustainable practices, and invasive species which undermine the terrestrial and

Interventions for Managing Disaster Risk Assessment and Climate Adaptation in The Bahamas, Table 3 Family disaster supplies kit for The Bahamas

<table>
<tr><td colspan="3">Keep the items that you would most likely need during an evacuation in an easy-to-carry container. Possible containers include a large, covered trash container, a camping backpack, or a duffle bag</td></tr>
<tr><td rowspan="3">Water
Store water in plastic containers such as soft drink bottles. Avoid using containers that will decompose or break, such as milk cartons or glass bottles. A normally active person needs to drink at least two quarts of water each day. Hot environments and intense physical activity can double that amount. Children, nursing mothers, and ill people will need more. Store one gallon of water per person
Keep at least a 3-day supply of water per day (two quarts for drinking, two quarts of water for each person in your household for food preparation/ sanitation)</td><td>Food
Store at least a 3-day supply of nonperishable food. Select foods that require no refrigeration, preparation, or cooking and little or no water. If you must heat food, pack a can of sterno. Select food items that are compact and lightweight. Include a selection of the following foods in your disaster supplies kit: Ready-to-eat canned meats, fruits, and vegetables</td><td rowspan="3">First aid kit
Assemble a first aid kit for your home and one for each car. A first aid kit should include sterile adhesive bandages in assorted sizes; assorted sizes of safety pins; cleansing agent/ soap; latex gloves (2 pairs); sunscreen; 2-inch sterile gauze pads (4–6); 4-inch sterile gauze pads (4–6); triangular bandages (3); 2-inch sterile roller bandages (3 rolls); 3-inch sterile roller bandages (3 rolls); scissors; tweezers; needle; moistened towelettes; antiseptic; thermometer; tongue blades (2); tube of petroleum jelly or other lubricant; nonprescription drugs
Nonprescription drugs – Aspirin or nonaspirin pain reliever; antidiarrhea medication; antacid (for stomach upset); syrup of ipecac (use to induce vomiting if advised by the Poison Control Center); laxative; activated charcoal (use if advised by the Poison Control Center)</td></tr>
<tr><td>Sanitation
Toilet paper, towelettes; soap, liquid detergent; feminine supplies; personal hygiene items; plastic garbage bags, ties (for personal sanitation uses); plastic bucket with tight lid; disinfectant; household chlorine bleach</td></tr>
<tr><td rowspan="2">Tools and supplies
Mess kits, or paper cups, plates, and plastic utensils; emergency preparedness manual; battery operated radio and extra batteries; flashlight and extra batteries; cash or traveler's checks, change; nonelectric can opener; utility knife; fire extinguisher: small canister a-b-c type; tube tent; pliers; tape; compass; matches in a waterproof container; aluminum foil; plastic storage containers; signal flare; paper, pencil; needles, thread; medicine dropper; shut-off wrench to turn off household gas and water; whistle; plastic sheeting; map of the area (for locating shelters)</td><td>Clothing and bedding
At least one complete change of clothing and footwear per person; sturdy shoes or work boots; rain gear; blankets or sleeping bags; bath towels; hat and gloves; thermal underwear; sunglasses</td></tr>
<tr><td rowspan="2">Special items
Remember family members with special needs, such as infants and elderly or disabled persons.
For baby – formula; diapers; bottles; powdered milk; medications
For adults – heart and high blood pressure medication; insulin; prescription drugs; denture needs; contact lenses and supplies; extra eye glasses</td><td>Important family documents
Keep these records in a waterproof, portable container: wills, insurance policies, contracts deeds, stocks, and bonds; passports, social security cards, immunization records; bank account numbers; credit card account numbers and companies; inventory of valuable household goods, important telephone numbers; family records (birth, marriage, death certificates)</td></tr>
<tr><td>Entertainment
Games and books</td></tr>
<tr><td colspan="3">Storing your disaster kit
Store your kit in a convenient place known to all family members. Keep a smaller version of the disaster supplies kit in the trunk of your car. Keep items in air tight plastic bags. Change your stored water supply every 6 months so it stays fresh. Replace your stored food every 6 months. Rethink your kit and family needs at least once a year. Replace batteries, update clothes, etc. Ask your physician or pharmacist about storing prescription medications</td></tr>
</table>

Source: Adapted from Government of The Bahamas (2011)

marine ecosystems. These recommendations are critical for the survival of this nation.

Nonetheless, there are specific implementation challenges related to SDG13. They include the following:

- Lack of collection of comprehensive spatial data and lack of a sea level and climate monitoring network.
- Lack of adequate financing for building resilience to climate change.

- Lack of complete economic valuations of all of the country's coastal and marine resources.
- Limited public awareness on the impacts of climate change – although this awareness has been increasing given the increase in the frequency of climate related events such as catastrophic hurricanes.

Despite some interventions to manage the risk of climate change in The Bahamas, on the whole, as reported by Thomas and Benjamain (2018), there have been limited policy responses by the government. Risk communication about climate change has been increasing, but is still largely undertaken by environmental nongovernmental organizations (NGOs). Further, a study by Thomas and Benjamin showed that The Bahamas is not doing enough to address climate change. Thus, developing and implementing policies aimed at reducing the risks of sea level rise, temperature increases, flooding, and extreme events may be the way to address this concern.

Conclusion

Political will is critical in tackling the climate change risk that is facing the world. This risk is a matter of the planet's survival. Participation in international organizations and initiatives is the way forward for all nations, including SIDS like The Bahamas, in fulfilling their responsibilities as members of the international community.

Cross-References

- ▶ Climate Change Adaptation (CCA)
- ▶ Climate Change and Education
- ▶ Climate Change Effects on People's Livelihood
- ▶ Climate Change Literacy to Combat Climate Change and Its Impacts
- ▶ Climate Change Planning: Understanding Policy Frameworks and Financial Mechanisms for Disaster Relief
- ▶ Disaster Risk Reduction
- ▶ Emergency Management/Response
- ▶ Extreme Weather Events: Definition, Classification, and Guidelines towards Vulnerability Reduction and Adaptation Management
- ▶ Human Settlements and Climate Change
- ▶ Immediate Climate Vulnerabilities: Climate Change and Planning Policy in Northern Communities
- ▶ Local Authority Capacity for Climate Action
- ▶ Making Communities Resilient to Global Climate Change
- ▶ Risk Assessment and Management
- ▶ Risk Management, Climate Change Related Risks, and the Precautionary Principle
- ▶ Risks and Opportunities due to Climate Change

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