A Blue Urban Agenda:

Adapting to Climate Change in the Coastal Cities of Caribbean and Pacific Small Island Developing States

Michelle Mycoo
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Inter-American Development Bank

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Project Manager and Design Editor:
Emilia Aragón.

Graphic and Editorial Design:
5 Sillas S.A.S. Bogotá, Colombia.

Designers:
Juliana Pedraza Kranz
Laura Morales García
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Maria Camila Prieto Abello

Typefaces:
Gotham and Times New Roman

ISBN Print: 978-1-59782-282-4
ISBN Digital: 978-1-59782-283-1

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CATALOGING-IN-PUBLICATION DATA PROVIDED BY THE INTER-AMERICAN DEVELOPMENT BANK FELIPE HERRERA LIBRARY

Mycoo, Michelle.
A blue urban agenda: adapting to climate change in the coastal cities of Caribbean and Pacific small island developing states
Michelle Mycoo, Michael G. Donovan.

p. cm. — (IDB Monograph ; 526)
Includes bibliographic references.

1. Climatic changes-Risk management-Caribbean Area. 2. Climatic changes-Risk management-Islands of the Pacific. 3. Coastal zone management-Caribbean Area. 4. Coastal zone management-Islands of the Pacific. 5. Urbanization-Caribbean Area. 6. Urbanization-Islands of the Pacific. I. Donovan, Michael G. II. Inter-American Development Bank. Housing and Urban Development Division. III. Title. IV. Series.

IDB-MG-526

JEL Codes:
F35, H84, N96, Q54, Q25, O18, O21

Keywords:
Foreign Aid, Coastal Cities, Resiliency, Sea Level Rise, Erosion, Mitigation, Caribbean, Housing, Disaster management, Small Island Developing States, Climate Finance, Pacific Islands, Climate Change Adaptation, Urban Planning, Urbanization.

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1300 New York Avenue, NW
Washington, DC 20577

ACKNOWLEDGEMENTS

The authors would like to thank all of the individuals from Caribbean and Pacific SIDS who supported this research project. Gerard P. Alleng, Emilia Aragón Rocha, Gabriel Arboleda, Keisha Bharath, Allen Blackman, Gilberto Chona, Camilo José Pecha Garzón, Santiago Levy Algazi, Sheila Mahoney, Jesús Navarrete, Juliana Pedraza Kranz, Martín J. Quiroga Barrera Oro, Colin Quinn, Robin Rajack, Mildred Rivera, Luis Guillermo Schloeter Garcia, Mark Stege, and Doni Wainiquolo all greatly enhanced the quality and design of this research. The authors also benefitted from comments from the Caribbean Community Climate Change Centre and panelists in the "Natural Capital, Climate Change and the Future of Coastal Cities" session held during the 2016 IDB-IIC Annual Meeting in Nassau, Bahamas. This publication was made possible by the support of the Institutional Capacity Strengthening Fund (ICSF), established through the contribution of the Government of the People's Republic of China.

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LIST OF ACRONYMS

ADB	Asian Development Bank
CARICOM	Caribbean Community
CBA	Community Based Adaptation
CBA	Cost-Benefit Analysis
CCA	Climate Change Adaptation
CCCCC	Caribbean Centre for Climate Change
CCDM	Climate Change Disaster Management
CCRIF	Caribbean Catastrophe Risk Insurance Facility
CDB	Caribbean Development Bank
CDEMA	Caribbean Disaster Emergency Management Agency
CDERA	Caribbean Disaster Emergency Response Agency
CDM	Comprehensive Disaster Management
CEA	Cost-Effectiveness Analysis
CEPEP	Community Environmental Protection and Enhancement Programme
CERTS	Community Emergency Response Teams
CIP	Coastal Improvement Programme
CPACC	Caribbean Planning for Adaptation to Climate Change Project
CZMU	Coastal Zone Management Unit
DD	Drainage Division
DFI	Development Finance Institutions
DFID	Department for International Development
DRM	Disaster Risk Management
EBA	Ecosystem Based Adaptation
EDWC	East Demerara Water Conservancy
EU-GCCA	Global Change Alliance through the European Union
FAP	Flood Alleviation and Drainage Program
GCCA: PSIS	Global Climate Change Alliance: Pacific Small Island States
GCF	Green Climate Fund
GDP	Gross Domestic Programme
GHG	Global Greenhouse Gases
GIS	Geographic Information System
GORTT	Government of the Republic of Trinidad and Tobago
ICLEI	International Council for Local Environmental Initiatives
ICMC	Integrated Coastal Management Committee
ICZM	Integrated Coastal Zone Management
IDB	Inter-American Development Bank
IPCC	Intergovernmental Panel on Climate Change
J-CCCP	Japan-Caribbean Climate Change Partnership
JICA	Japanese Investment Cooperation Agency
LAC	Latin American and the Caribbean
LECZ	Low Elevation Coastal Zone
LIDAR	Light Imaging, Detection, and Ranging
MCA	Multi-Criteria Analysis
MEWR	Ministry of the Environment and Water Resources
MHWM	Mean High-Water Mark
NAPA	National Adaptation Programme of Action
NPIS	National Public Investment Systems
ODPM	Office of Disaster Preparedness and Management
OECS	Organization of Eastern Caribbean States
PIP	Public Investment Programme
RSLR	Relative Sea-Level Rise
SIDS	Small Island Developing States
SLM	Sustainable Land Management
SLR	Sea Level Rise
UNDESA	United Nations Department of Economic and Social Affairs
UNDP	United Nations Development Programme
UNECLAC	United Nations Commission for Latin America and the Caribbean
UNFCCC	United Nations Framework for Combating Climate Change
UN-Habitat	United Nations Human Settlements Programme
UN-OHRLLS UN	Office of the High Representative for the Least Developed Countries,Landlocked Developing Countries and Small Island Developing States
USD	United States Dollar

EXECUTIVE SUMMARY

Coastal cities of Caribbean and Pacific Small Island Developing States (SIDS) are highly vulnerable and will be among the earliest and most affected by climate change in the coming decades. Approximately 29 million people reside in Caribbean and Pacific SIDS, 4.2 million of which reside in low-elevation coastal zones (LECZs) located less than 10 meters above the sea level. The cost of damage to critical infrastructure that supports human settlements along the coast that results from rising sea levels will be a financial burden to many SIDS. By 2100, the cost of rising sea levels as a percentage of GDP will be highest among SIDS and enormous relative to the size of their economies. Impacts could include a decline in national output, inflation, increasing debt, revenue loss, and employment decline. Adapting and improving the resilience of cities in coastal zones of SIDS, especially those experiencing rapid urbanisation, remains critical.

The unique patterns of urban growth in SIDS increase their vulnerability to climate change. This model includes:

(i) *rapid rates of urbanisation,*

(ii) *primate cities that are often located in vulnerable coastal locations,*

(iii) *LECZ cities with high coastline residential densities,*

(iv) *urban centres with high levels of informal urbanism, and*

(v) *port cities that are increasingly affected by coastal development (Box 1). In the future, these trends will have significant implications for adaptation strategies.*

SIDS can seize opportunities to minimise the impact of greenhouse gas (GHG) emissions, as well as rising sea levels and natural hazards on their urban centres, once existing limited governance, technical, financial, and institutional capacities are addressed. Caribbean and Pacific SIDS efforts to implement three main adaptation strategies —protection, accommodation, and retreat— and adopt basic adaptation strategies aimed at reducing vulnerability and enhancing sustainability are reviewed in this book. This is all the more important given that Caribbean and Pacific SIDS are important economically, representing an economy worth US$540 billion.

The SIDS donor mapping analysis in this book illustrates how the international community has responded positively to the challenge of adapting to climate change in SIDS. The international community provided $55.6 billion in private sector flows and Official Development Assistance (ODA) to Caribbean and Pacific SIDS between 1995 and 2015, nearly doubling average annual flows (in current prices). Aid to SIDS is increasingly channelled through multilateral development banks, including the Inter-American Development Bank which has financed $200 million in more than 50 programs in coastal city adaptation and improved urban planning in Caribbean SIDS. SIDS have also leveraged green climate funding, securing US$460 million in green finance for the Caribbean and US$335 million in the Pacific.

LOW ELEVATION COASTAL ZONES IN CARIBBEAN AND PACIFIC SIDS

BOX 1

- **In Caribbean and Pacific SIDS, 4.2 million residents live in low elevation coastal zones (LECZs) located less than 10 metres above the sea level.**

- **One out of five residents of Caribbean and Pacific SIDS live in low elevation coastal zones. This is most extreme in The Bahamas and the Republic of the Marshall Islands where over 80% of their populations live in LECZs.**

- **16.5% of the land area of Caribbean and Pacific SIDS lies is located less than 10 metres above the sea level. The Bahamas (88.8% of land), Kiribati (84.5%), and the Republic of the Marshall Islands (73.4%) are the most affected.**

- **928,709 square kilometres of land are located is low elevation coastal zones in Caribbean and Pacific SIDS.**

- **The international community provided $55.6 billion in private sector flows and Official Development Assistance (ODA) to Caribbean and Pacific SIDS between 1995 and 2015, nearly doubling average annual flows (in current prices).**

While earlier programs were largely sectoral, more emphasis has been placed on comprehensive programs and strengthening city resiliency over the past six years. A review of the city resiliency projects in these SIDS shows an increasing emphasis on urban governance and institutional capacity building within city planning agencies. Despite this progress, the report's review of donor activity in SIDS highlights challenges, including:

- Competition for aid
- Limited local human resource capacity (e.g., project management skills)
- Limited stakeholder engagement and project buy-in
- Duplication of effort among donor agencies
- Limited private sector involvement
- Change in political administrations
- Changing money flows and priorities, which together can delay project implementation and compromise the goal of making optimal adaptation decisions

This book makes several policy recommendations to mainstream resiliency to climate change in SIDS' towns and cities. Recommendations include land use planning, promoting compact urban form, using building codes, upgrading infrastructure, developing green infrastructure and ecosystem-based adaptations (EBAs), reducing disaster risk, building institutional capacity and effective urban governance, building capabilities for data acquisition, monitoring and evaluating results, and exploring an array of financial instruments to mobilise fiscal resources to strengthen city resiliency. Action is particularly urgent for rapidly urbanizing SIDS, such as the Solomon Islands whose urban population is growing at more than double the speed of the global average.

This book is organized in six chapters:

Chapter one provides context for the vulnerability of SIDS to climate change, including sea level rise (SLR) and natural hazards, the agreements reached at the Paris Climate Conference (COP21) to minimise these threats, and discussions on implementing Sustainable Development Goals (SDGs).

Chapter two reviews the impacts of climate change and the vulnerability of SIDS through an urban lens.

Chapter three reviews approaches to adaptation and selected measures adopted by SIDS in response to climate change challenges.

Chapter four critiques donor projects that address climate change adaptation in SIDS on the whole and specifically the projects funded by national governments, donors, and development finance agencies to help SIDS cities minimise the impacts of climate change.

Chapter five offers policy recommendations to tackle coastal city vulnerability and strengthen city resiliency to the adverse consequences of climate change.

Chapter six concludes with a New Urban Agenda strategy for SIDS to assist them in combating climate change and to provide a new way forward that is consistent with the COP21 accord and the SDGs. Under the New Urban Agenda, the United Nations acknowledged the importance of the COP21 agreement and underscored the special circumstances of SIDS in relation to size, resources and vulnerability to climate change and natural hazards. A commitment was made by member countries to facilitate urgent action to promote environmentally sustainable and resilient urban development in these small states.

FIGURE 0.1

SUMMARY OF POLICY RECOMMENDATIONS FOR SIDS COASTAL CITY ADAPTATION AND RESILIENCE

Source: Authors.

Policies	Example of Measures	
Mixed adaptation measures	• Protection, Accommodation and Retreat • Ecosystem-based approaches (green infrastructure) • Conservation of wetlands, watersheds and coral reefs	1
Integrated and sustainable spatial planning	• Work across sectors and scales and at different governance levels • Promote compact urban form • Conduct city resilience profile • Revise zoning, building codes and infrastructure standards	2
Climate resilient coastal urban infrastructure	• Strengthen coastal defences to protect roads, airports, ports	3
Prioritise investments	• Mainstream climate change adaptation in national public investment systems • Calculate and compare benefits of costs of different adaptation proposals	4
Finance: Improve readiness to access and utilize climate funds and insurance	• Train human resources to navigate international financial system and access insurance funds	5
Integrate climate change adaptation with disaster risk reduction	• Incorporate disaster risk reduction policies into city climate change adaptation plans	6
Governance and institutional capacity building	• Capacity building for professionals to adopt innovative technologies for climate change adaptation (CCA) in coastal cities; • Regional training workshops in CCA and disaster risk management • Strengthen capacity of local governments in plan, implement, monitor, and evaluation adaptation • Acquire Data using new technologies (GIS, LIDAR, LANDSTAT, drones)	7

CONTEXT

1

PARAMARIBO 2016

1

CONTEXT: SITUATING SIDS IN THE GLOBAL DEVELOPMENT AGENDA

Coastal cities in the Caribbean and the Pacific are highly vulnerable given current rates of erosion and research that indicates that SIDS will be among the earliest and most affected by climate change in the coming decades. Inadequately maintained infrastructure such as seawalls and drainage systems will exacerbate vulnerability, and the increasing intensity of hurricanes and floods is expected to be costly. Projected annual costs from SLR in 2050 range from US$3.9 billion to US$6.1 billion for all CARICOM nations (Simpson, Scott, Harrison, et al., 2010). If the sea level rises between 30 and 50 centimetres, the estimated direct cost to the Pacific Islands is approximately US$1.4 million per year (IFAD, 2017). As the coasts of SIDS urbanise, it will be critically important to build, adapt, and improve the resilience of these cities.

Approximately 27 million persons live in urban settlements in Anglophone, Hispanic, and Francophone Caribbean SIDS (United Nations, 2014). This includes 3.5 million in nations states of the Anglophone Caribbean, 17 million persons in Cuba and the Dominican Republic, and 6.2 million in Haiti. In most Caribbean SIDS, more than half of the population lives in urban areas, and empirical evidence. In most Caribbean SIDS, more than half of the population lives in urban areas, and empirical evidence confirms that most of the urban population is concentrated in the coastal zone. In the Pacific region, over 90 percent of the population, which includes both rural and urban inhabitants, lives on the coast.

SIDS are characterised by a rich biodiversity and comprise many of the world's ecological hotspots of flora and fauna found nowhere else on earth. The contribution of the 52 states that make up this group of nations to global biodiversity significantly exceeds their land area (see Table 1.1)[1]. The biodiversity of SIDS is essential for productivity, the functioning of ecosystems, and adaptability to climate change. However, urbanisation places a unique stress on wetlands, mangrove forests, and coral reefs, which are designed to provide ecosystem services such as protection against floods, storm surges, and coastal erosion.

Climate change is also placing stress on these fragile ecosystems, which are vulnerable to storms, hurricanes, and rising sea surface temperatures, thereby reducing their capacity to protect coastal cities and infrastructure from flooding and erosion.

Past unsustainable land development practices, especially in urban areas, have made many SIDS even more vulnerable to climate change. Many factors have destroyed ecologically fragile ecosystems and compromised urban sustainability, including the following:

- Deleterious land use practices, partly brought about by unresolved land conflicts stemming from inherited land tenure systems associated with plantation economies
- Outdated land registration systems
- Weak enforcement of physical development plans, policies, and environmental regulations (Mycoo, 2005; Mycoo, 2016a)
- Poorly selected sites for urban settlement
- Inadequate enforcement of development standards and building codes
- Profound deficits in governance and infrastructure
- Economic and social inequality
- Limited application of tools to measure the value of environmental resources in protecting urban assets

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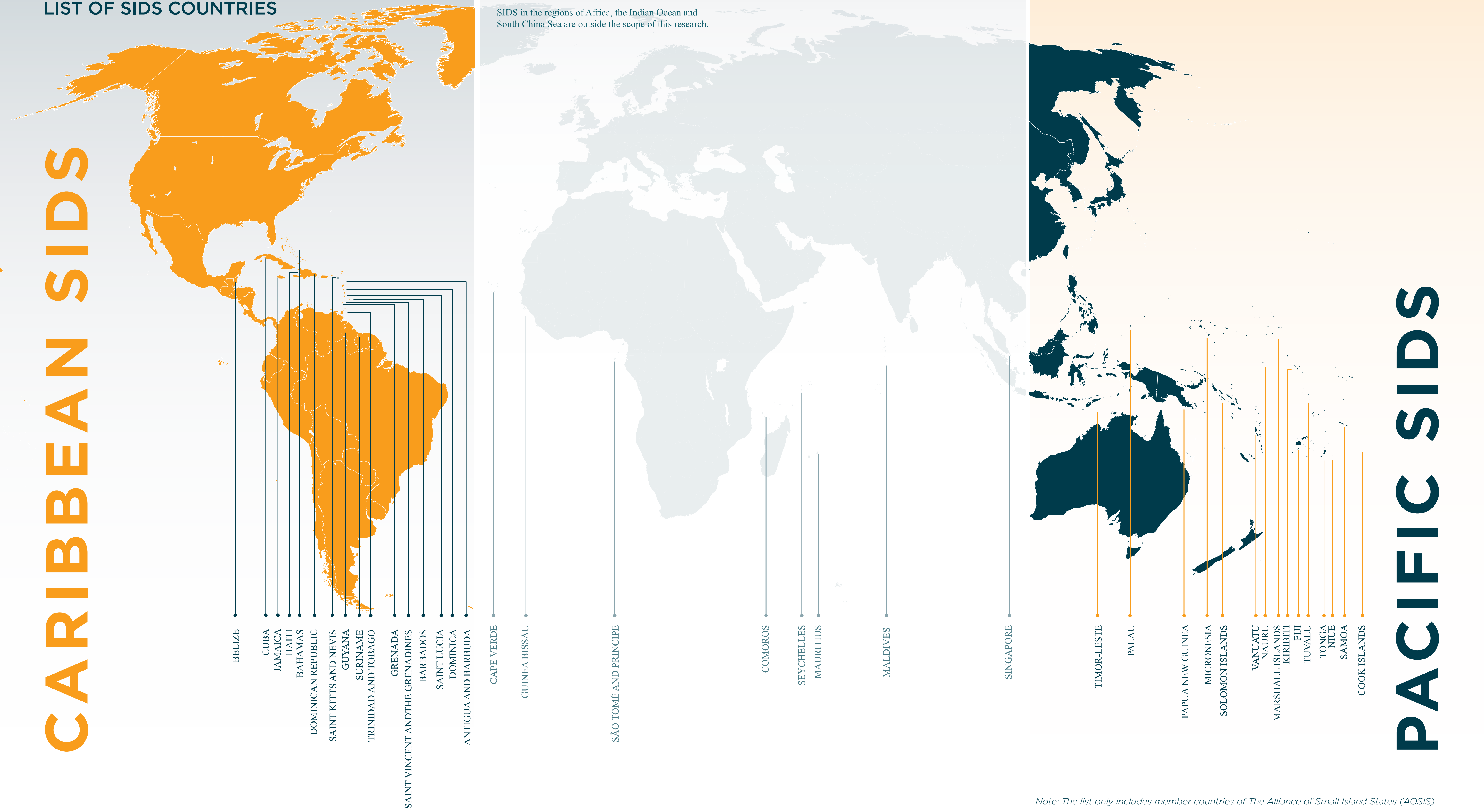
[1] *This is the list of states used by the United Nations Department of Economic and Social Affairs (UN DESA).*

TABLE 1.1
LIST OF SIDS COUNTRIES



AFRICA, INDIAN OCEAN AND SOUTH CHINA SEA

SIDS in the regions of Africa, the Indian Ocean and South China Sea are outside the scope of this research.

Note: The list only includes member countries of The Alliance of Small Island States (AOSIS). http://aosis.org/about/members/.

A new response for reducing vulnerability in coastal zones has emerged, transcending traditional paradigms in urban planning. For the past two decades, policymakers typically employed two paradigms to shape cities: a Brown Agenda and a Green Agenda.

While the Brown Agenda focused on social justice in cities and the immediate problems at the local level, especially those suffered by low-income groups in post-industrial areas, environmentalists, on the other hand, championed for a Green Agenda to protect ecosystems from the immediate and deferred effects of human activity at the regional and global scale. Despite the achievements of the Brown and Green agendas, they largely ignored oceans and marine environments. The maps we use for cities and the urban policies that emerge from these agendas often contained a very hard line between land and water, which ignored the constant interplay between land and sea that characterize so many coastal cities (Donovan, 2016a). This report, however, catalogues the evolution of a new approach throughout Caribbean and Pacific SIDS: A Blue Urban Agenda. This agenda recognizes the synergies between terrestrial and aquatic areas in cities and calls for water-sensitive urban development (Donovan, 2016b). While many advocates of this approach have worked somewhat isolated in municipal and community levels, a series of SIDS initiatives has established new transnational forms of support, city-to-city learning, and monitoring.

The international mobilization around a SIDS-specific agenda was voiced through the SIDS Accelerated Modalities of Actions (or SAMOA Pathway), adopted during the Third International Conference on Small Island Developing States in 2014. Signatories of the Samoa Pathway articulated the need for action: "we acknowledge that climate change and sea-level rise continue to pose a significant risk to small island developing States and their efforts to achieve sustainable development and, for some, represent the gravest threat to their survival and viability" (United Nations General Assembly, 2014). The document also recognized the leadership role of small island developing States in advocating for ambitious global efforts to address climate change and of raising awareness of ambitious action to address climate change at the global level. Equally important, signatories recognized that the adverse impacts of climate change place additional burdens on efforts to achieve the sustainable development goals.

During COP21 (2015), SIDS actively participated and supported the global agreement among 195 countries to pursue global action to avoid dangerous climate change by limiting global warming to well below 2°C. The agreement highlighted that the international community should be aiming to reduce the rise in temperature to 1.5°C in order to protect island states faced with the threat of SLR. Despite the mobilisation shown by states, at this rate, global warming will still be between 2.7°C and 3.0°C, which is above the threshold set by scientists. The accord has significant implications for the decisions SIDS will make with respect to adaptation strategies. The key elements of COP21 include:

- Reducing emissions
- Requiring transparency and accountability in meeting targets to reduce GHG emissions
- Adapting to the impacts of climate change
- Reducing loss and damage associated with climate change
- Clarifying the role of cities, regions, and local authorities (critical stakeholders) in scaling-up efforts to reduce emissions, build resilience, and decrease vulnerability to climate change
- Developed countries assisting developing countries in building resilience
- Adapting to climate change

Several SIDS have underscored incorporating the key COP21 elements into national climate change action plans. Moreover, they were all signatories to the Agreement in April 2016 and the majority of islands in the Caribbean and Pacific ratified the COP21 agreement.

The Habitat III (Third United Nations Conference on Housing and Sustainable Urban Development) Quito Declaration on a New Urban Agenda (2016) noted that the world is still far from addressing sustainable cities, human settlements for all, and existing challenges such as climate change. The declaration called on countries to take advantage of the opportunities for urbanisation to be an engine of sustained and inclusive economic growth, social and cultural development, and environmental protection, and on its potential contributions to achieving transformative and sustainable development. The declaration noted that "urban centres worldwide, especially in developing countries, often have characteristics that make them and their inhabitants especially vulnerable to the adverse impacts of climate change and other natural and human-made hazards… which particularly affect coastal areas, delta regions and small island developing States…" (United Nations General Assembly, 2016). Implementation of the Habitat III declaration on the New Urban Agenda is of paramount importance in helping SIDS adapt to the effects of climate change, especially where they are manifested in their highly vulnerable coastal cities.

This report focuses on the Caribbean SIDS[2] that are member countries of CARICOM.

1 A review of the vulnerability of SIDS to climate change, including SLR and natural hazards

2 An analysis of the unique urbanisation trends in SIDS

3 A review of adaptation approaches and selected measures adopted by SIDS in response to climate change challenges

4 A critique of donor projects that address climate change adaptation in SIDS, specifically projects in urban areas

5 Policy recommendations to bolster coastal city resilience

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[2] *SIDS in the African, Indian, and South China Seas are outside the scope of this project. The content of this report does not include analysis of programmes in Cuba and the Dominican Republic, which are not members of CARICOM. However, both countries are included in various figures of this report.*

CLIMATE CHANGE

2

NASSAU 2015

SIDS account for less than 1 percent of global GHG emissions, but their size, geography, and relative insularity and remoteness make them particularly vulnerable to the effects of climate change, with the possible outcomes being far worse than for other countries (UN-OHRLLS, 2012). With the exception of the oil-producing island of Trinidad and Tobago, most Caribbean SIDS contribute little to GHG emissions. Figure 2.1 shows that the Pacific SIDS are contributing less to GHG emissions compared to Caribbean SIDS that make up the LAC region.

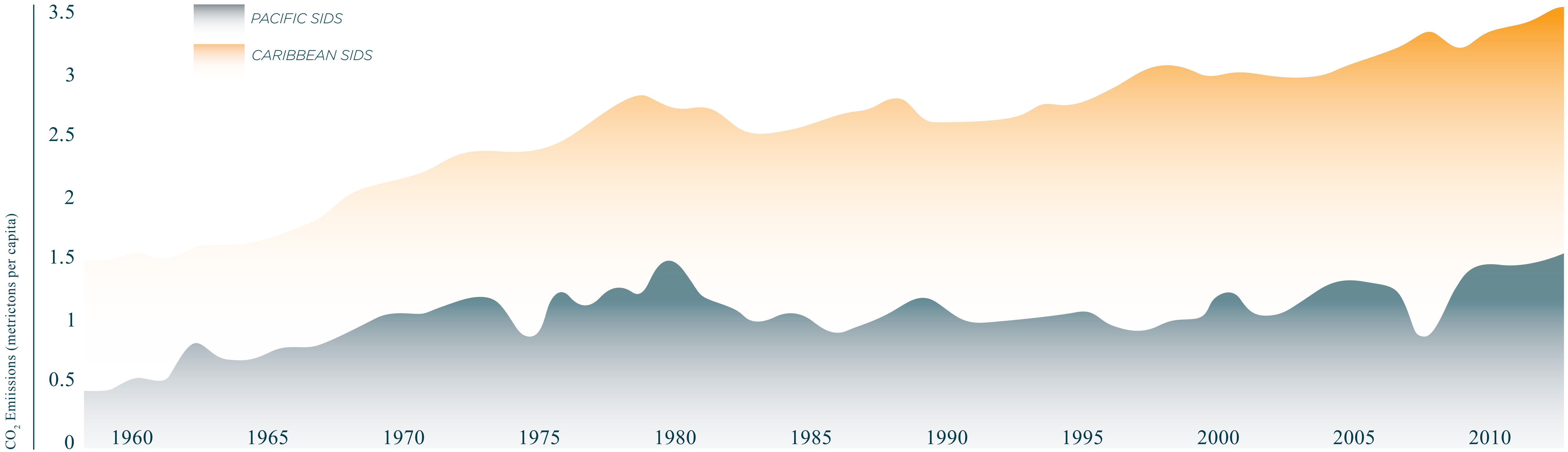
> “THE LARGEST OPPORTUNITIES FOR FUTURE URBAN GHG EMISSIONS REDUCTION ARE IN RAPIDLY URBANISING AREAS WHERE URBAN FORM AND INFRASTRUCTURE ARE NOT LOCKED-IN....”
>
> *(Seti, et al., 2014).*

Notwithstanding the small carbon footprints of SIDS, urban centres in these countries can explore possibilities to minimise GHG emissions at the global level. One key message of the Intergovernmental Panel on Climate Change’s (IPCC) Fifth Assessment Report is that *“The largest opportunities for future urban GHG emissions reduction are in rapidly urbanising areas where urban form and infrastructure are not locked-in....”* (Seto and Khakal, 2014). SIDS urban centres can seize these opportunities once existing limited governance, technical, financial, and institutional capacities are addressed. As Seto et al. (2014) observed, the feasibility of spatial planning instruments to mitigate climate change is highly dependent on a city’s financial and governance capabilities.

Despite their small contribution to global warming, SIDS can benefit from successfully implementing strategies to mitigate urban climate change. *“Urban areas throughout the world continue to struggle with challenges, including ensuring access to energy, limiting air and water pollution, and maintaining employment opportunities and competitiveness. Action on urban-scale mitigation often depends on the ability to relate climate change mitigation efforts to local co-benefits. The co-benefits of local climate change mitigation can include public savings, air quality and associated health benefits, and productivity increases in urban centres, providing additional motivation for undertaking mitigation activities”*
(Seto et al., 2014: 928).

FIGURE 2.1

CARBON DIOXIDE EMISSIONS PER PERSON IN CARIBBEAN AND PACIFIC SIDS



Source: World Bank World Development Indicators (2013).

2.1

IMPACTS OF CLIMATE CHANGE AND VULNERABILITY

1

FLOOD EARLY WARNING SYSTEMS IN HAITI. OCT, 2012

Significant economic impacts are associated with climate change, which in most SIDS, include GDP loss, inflation, increasing debt, revenue loss, and employment decline. The World Bank (2012) estimates that the potential economic impact of climate change on CARICOM SIDS, would average about 5.6 percent of gross domestic product (GDP) (low scenario) to more than 34 percent of GDP (high scenario). Approximately 66 percent of the population will be affected by 2080 (Bueno et al., 2008). For the CARICOM tourism sector, estimates of economic impacts from climate change through 2020 show that, if infrastructure is retrofit, the potential losses would be one-fifth of those without retrofitting, clearly illustrating the benefits of anticipatory adaptation (Attz, 2004).

The Pacific region will require an estimated average of US$447 million per year until 2050, or 1.5 percent of GDP, to prepare for climate change impacts under a business-as-usual scenario. The cost may be even greater, reaching US$775 million or 2.5 percent of GDP per year (ADB, 2013). Additionally, climate change under all scenarios may reduce the Pacific region's tourism revenue by 27 to 34 percent (ADB, 2013).

2.1.1

SEA LEVEL RISE

The topography of many volcanic SIDS is generally rugged and mountainous, with small areas of flat coastal lands. Several are primarily coral islands, which tend to be flat, and in some cases, are either at or below sea level. SLR is of great concern for SIDS, particularly the low-lying states. However, rates of SLR are not uniform across the globe and large regional differences have been detected, including in the Indian Ocean and tropical Pacific, where rates have been significantly higher in some parts than the global average (Meyssignac, Becker, Llovel, et al., 2012). The average rate of SLR is estimated to be 0.77 millimetres per year around the Pacific Region, 1 millimetres in the Caribbean, and 1.5 millimetres in the Indian Ocean (UN-OHRLLS, 2008).

> “IN THE FUTURE IT IS VERY LIKELY THAT THERE WILL BE A SIGNIFICANT INCREASE IN THE OCCURRENCE OF SEA LEVEL EXTREMES AND SIMILARLY TO PAST OBSERVATIONS, THIS INCREASE WILL PRIMARILY BE THE RESULT OF AN INCREASE IN MEAN SEA LEVEL”
>
> *(Stocker, et al., 2013).*

“In the future it is very likely that there will be a significant increase in the occurrence of sea level extremes and similarly to past observations, this increase will primarily be the result of an increase in mean sea level” (Stocker et al., 2013). Under all Representative Concentration Pathways scenarios, the rate of SLR will very likely exceed that observed between 1971 and 2010 due to increased ocean warming and increased loss of mass from glaciers and ice sheets (IPCC, 2013). The annual projected change in sea level between two time periods nearly one hundred year apart (1986-2005 and 2081-2100) is 0.5 to 0.6m in the Caribbean, the Northern Tropical Pacific, and the Southern Pacific (Nurse et al., 2014). More recent estimates show a trend in the relative SLR for the coastal zones in the Caribbean East as 3.5 (±3.22) millimetres per year and the Caribbean Sea 2.0 (±3.14) millimetres (Rietbroek, Brunnabend, Kusche, et al., 2016).

In contrast to other geographic areas, small islands are at greater risk from SLR because most of their population and infrastructure are concentrated in the coastal zone. Conservative estimates suggest that nearly 11 percent of people in SIDS live (with striking variations between the states) in zones where the elevation is below 5 metres (UN-Habitat, 2015). In both the Caribbean and the Pacific, for example, more than 50 percent of the population lives within 1.5 kilometres of the shore, and major infrastructure such as airports, roads, and capital cities are located in the coastal zone (Mimura, Nurse, Mclean, et al., 2007; ADB, 2013). Hay, Mimura, Campbell, et al. (2003) identified several challenges for the transportation sector in Pacific island countries that would result from SLR, including closure of roads, airports, harbours, bridges, and other vital infrastructure systems due to flooding and erosion (see Figure 2.2). These incidences will have adverse effects for SIDS, especially in times of disasters when such infrastructure is vital for relief, supply, and other essential functions.

2

3

Source: Wikimedia Commons

4

FIGURE 2.2

SUSCEPTIBILITY TO FLOODING AND STORM SURGE: MONTEGO BAY

Source: Government of Jamaica and IDB (2015).

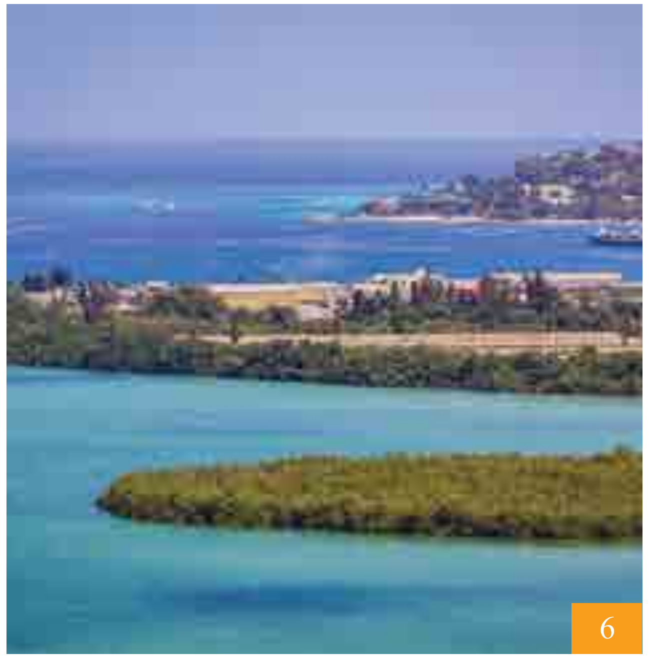
Susceptibility to selected Hazards

HAZARDS

- ▬ *Urban Boundaries*
- ■ *Downtown Area*
- ■ *Open Green Space*
- ■ *25 year flood*
- ■ *25 year storm surge*
- ■ *Alluvial plains*
- ■ *Airport*

By 2100, the cost of SLR as a percentage of GDP will be highest among SIDS. The damage costs for these small states are enormous relative to the size of their economies (Nicholls and Tol, 2006). Palau, the Marshall Islands, Nauru, and the Federated States of Micronesia (Pacific SIDS) and The Bahamas (Caribbean SIDS) are the top five SIDS most affected by SLR. Furthermore, research by Scott, Mimura, Campbell, et al. (2012) revealed, if a projected SLR of 1 metre was imposed on topographic maps, approximately 49 to 60 percent of tourism resort properties in the Caribbean would be damaged. (See Box 2.1 for an example of the impact of SLR on Barbados.)


5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BOX 2.1

SEA LEVEL RISE AND VULNERABILTY OF CITIES AND TOURISM IN BARBADOS

Currently the majority of Barbados' population lives in the main urban corridor and 75.9 percent live within 5 kilometres of the coastline (UNECLAC, 2014). Population density projections suggest that over the next 100 years there will be an increase in its most urbanised zone, the outcome of which will be increased vulnerability in the low elevation coastal zone (LECZ). The estimated value of assets exposed was approximately US$3.3 billion (UNECLAC, 2001). The shipping port, airport, and both of the main highways are in the LECZ and are therefore highly vulnerable. Tourism, the country's main economic sector, is highly vulnerable. About 80 percent of the island's hotels are located within 250 metres of the high-water mark. The larger hotels are generally located within the LECZ, which places them at risk to SLR and storm surges.

2.1.2

NATURAL HAZARDS

Observed data reveal trends in extreme events that are consistent with those projected to occur as a consequence of climate change. For both the Indian and Southwest Pacific Oceans, a significant increase in the number and proportion of hurricanes reaching categories 4 and 5 has been observed over the past 35 years (Webster, Holland, Curry, et al., 2005). Additionally, although the Caribbean has focused mainly on floods and storms, the drought of 2009–10 was the worst in more than 40 years (UN FAO, 2016).

Natural hazards such as hurricanes and tropical cyclones, floods and droughts have had detrimental effects on the economies and livelihoods of populations living in SIDS. Such events often disrupt economic activity throughout these territories, unlike larger countries where economic disruption may be limited to parts of the country (Anthoff, Nicholls, and Tol, et al., 2010). The high impact of natural hazards on climate sensitive sectors such as tourism and agriculture is common. However, the housing and education sectors also suffer severe damage and high losses.

Within a single year, economic losses due to the 2004 hurricane season cost Caribbean countries approximately US$4.5 billion (World Bank, 2007a). Damage done by category 5 Hurricane Ivan to Grenada totalled 227 percent of its GDP (UNECLAC, 2004). In 2012, Tropical Cyclone Evan caused US$203 million in damage, or about 28 percent of Samoa's GDP (Government of Samoa, 2013). Tropical Cyclone Winston, a category 5 that occurred in February 2016 and Fiji's strongest tropical cyclone on record, caused over £329 million (US$158 million) in losses (Cheong, 2016). Tropical Storm Erika wiped out 90 percent of Dominica's GDP. Figure 2.3 shows the cost of damage from severe storms in the Caribbean. For Montego Bay, considering both a 25- and a 50-year return period, the average annualised losses from storm surges is approximately J$609 million (US$5.4 million). The maximum probable loss from a 50-year storm surge is an estimated J$17.9 billion (US$159 million) (IDB, 2014).


7


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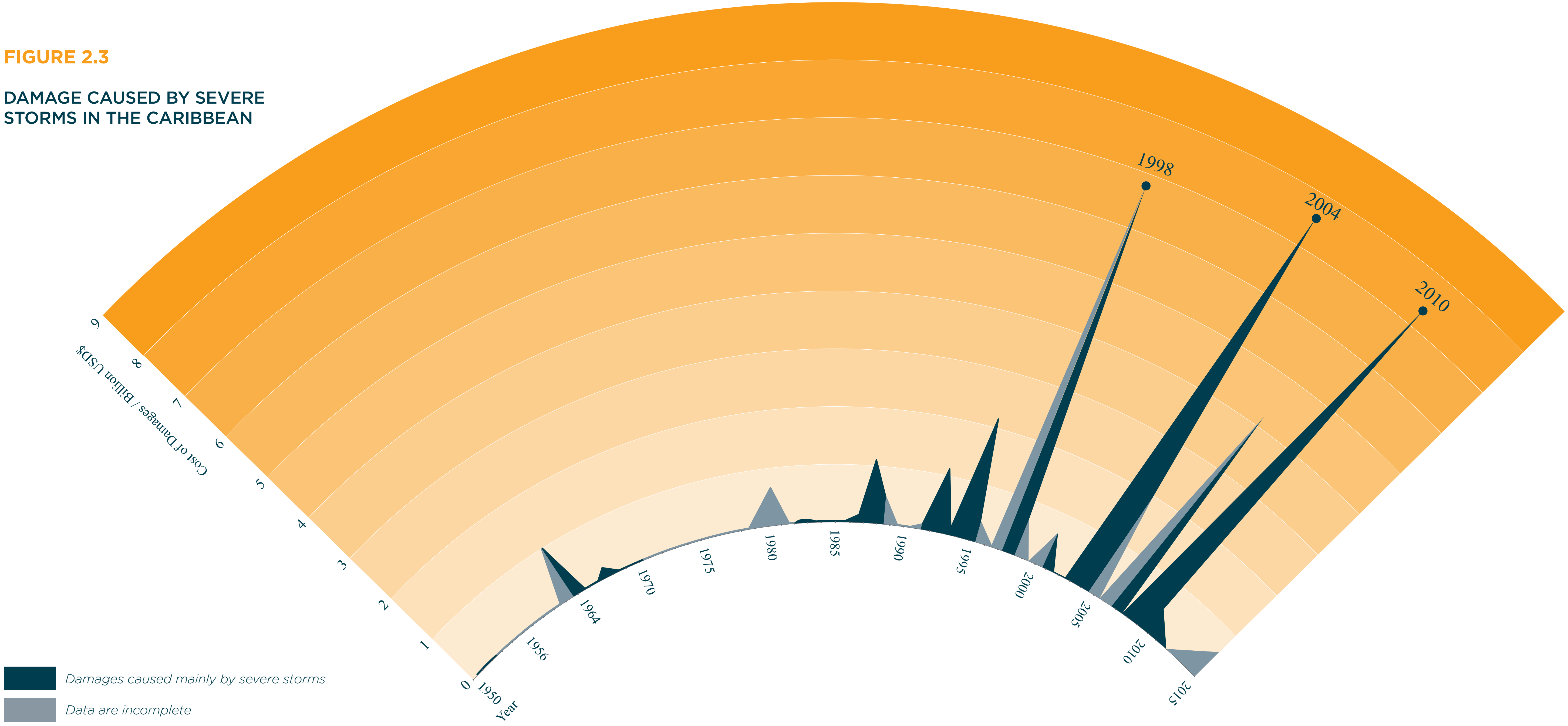
FIGURE 2.3

DAMAGE CAUSED BY SEVERE STORMS IN THE CARIBBEAN



Carol	**1954**
Edna	1954
Hazel	**1954**
Connie	**1955**
Diane	**1955**
Ione	**1955**
Janet	**1955**
Audrey	**1957**
Donna	**1960**
Carla	**1961**
Hattie	**1961**
Flora	**1963**
Cleo	**1964**
Dora	**1964**
Hilda	**1964**
Betsy	**1965**
Inez	**1966**
Beulah	**1967**
Edna	**1968**
Camille	**1969**
Celia	**1970**
Edith	1971
Agnes	**1972**
Carmen	**1974**
Fifi	**1974**
Eloise	**1975**
Anita	**1977**
David	**1979**
Frederic	**1979**
Tropical Storm Claudette	1979
Allen	**1980**
Hermine	**1980**
Alicia	**1983**
Elena	**1985**
Gloria	**1985**
Floyd	**1987**
Gilbert	**1988**
Joan	**1988**
Hugo	**1989**
Karen	**1989**
Diana	**1990**
Klaus	**1990**
Bob	**1991**
Andrew	**1992**
Bert	**1993**
Gert	**1993**
Gordon	**1994**
Tropical Storm Alberto	1994
Luis	**1995**
Marilyn	**1995**
Opal	**1995**
Roxanne	**1995**
Cesar	**1996**
Fran	**1996**
Hortense	**1996**
Bonnie	**1998**
Georges	**1998**
Mitch	**1998**
Floyd	**1999**
Lenny	**1999**
Keith	**2000**
Allison	**2001**
Iris	**2001**
Michelle	**2001**
Tropical Storm Allison	2001
Isidore	**2002**
Lili	**2002**
Fabian	**2003**
Isabel	**2003**
Juan	**2003**
Charley	**2004**
Frances	**2004**
Ivan	**2004**
Jeanne	**2004**
Dennis	**2005**
Emily	**2005**
Katrina	**2005**
Rita	**2005**
Stan	**2005**
Wilma	**2005**
Dean	**2007**
Felix	**2007**
Noel	**2007**
Gustav	**2008**
Ike	**2008**
Paloma	**2008**
Alex	2010
Danielle	2010
Earl	2010
Igor	**2010**
Julia	2010
Karl	2010
Otto	2010
Paula	2010
Richard	2010
Shary	2010
Tomas	**2010**
Irene	**2011**
Sandy	**2012**
Ingrid	**2013**
Erika	**2015**
Joaquin	**2015**
Matthew	**2016**

In many SIDS, most coastal cities and towns are experiencing the immediate impacts of climate change, such as the increased frequency and magnitude of hurricanes, cyclones, storms, and droughts. Losses resulting from these events include loss of human life, housing and other property, critical urban infrastructure, livelihoods, GDP, and natural resources. Also, health and safety are at risk. In the city of Georgetown, Guyana, the 2005 flood immobilised most of the population, cost the equivalent of 59 percent of the country's GDP, and had severe socio-economic and public health impacts on 72 percent of the city's population (UNECLAC, 2005). Hurricane Tomas severely damaged Saint Lucia's housing sector, with losses amounting to EC$192 million (US$71.1 million). A large number of houses in the cities of Castries and Soufriere were badly damaged or destroyed. Infrastructure and educational facilities were also damaged (see Figure 2.4).

Source: The OFDA/CRED International Disaster Database, Belgium.

In the South Pacific, Tropical Cyclone Winston caused serious damage in Fiji (see Figure 2.5). Kiribati suffered from a shortage of water that approached disaster levels. Overuse of Nauru's freshwater lens during the Pacific drought between 1998 and 2001 caused the groundwater to be contaminated. Viti Levu, Fiji, a relatively high island, could face agricultural losses of up to US$52 million by 2050 if adaptation measures are not taken. At worst, flooding and droughts render whole islands uninhabitable, which can lead to their abandonment, migration of the population to the main urban region of Greater Suva, and conflicts over natural resources.

According to forecasts for SIDS in both regions, losses will grow in the future, resulting in major drawbacks to socio-economic development. The most challenging aspect of the increasing frequency and magnitude of natural hazards is the need to divert scarce resources from development projects to relief and reconstruction efforts. In the Eastern Caribbean, building quality and location are not typically factored into insurance availability or cost. Due to missing incentives to mitigate the impacts of extreme climatic events and given that only a small percentage of the risk is retained by local insurance companies, buildings are often ill-prepared targets for extreme weather events or climate change. Instead, insurance companies are encouraged by the system to underwrite as many policies as possible, regardless of their soundness (UN-Habitat, 2011a).

Many SIDS already face economic vulnerabilities because of a high degree of exposure to economic dependence on a narrow natural resource base, a limited range of exports, and a high degree of dependence on strategic imports such as food and fuel (Briguglio, Cordina, Farrugia et al., 2009). Small size also influences high overhead cost per capita, especially outlay for infrastructure (Nurse et al., 2014). This is a concern for decision-makers who must determine adaptation measures such as infrastructure upgrades and infrastructure redesign.

9

AFTERMATH OF CYCLONE WINSTON IN FIJI. FEB 25, 2016

Source: SBS.com

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SANTIAGO DE LOS CABALLEROS 2015

3

UNIQUE URBANISATION TRENDS IN SIDS

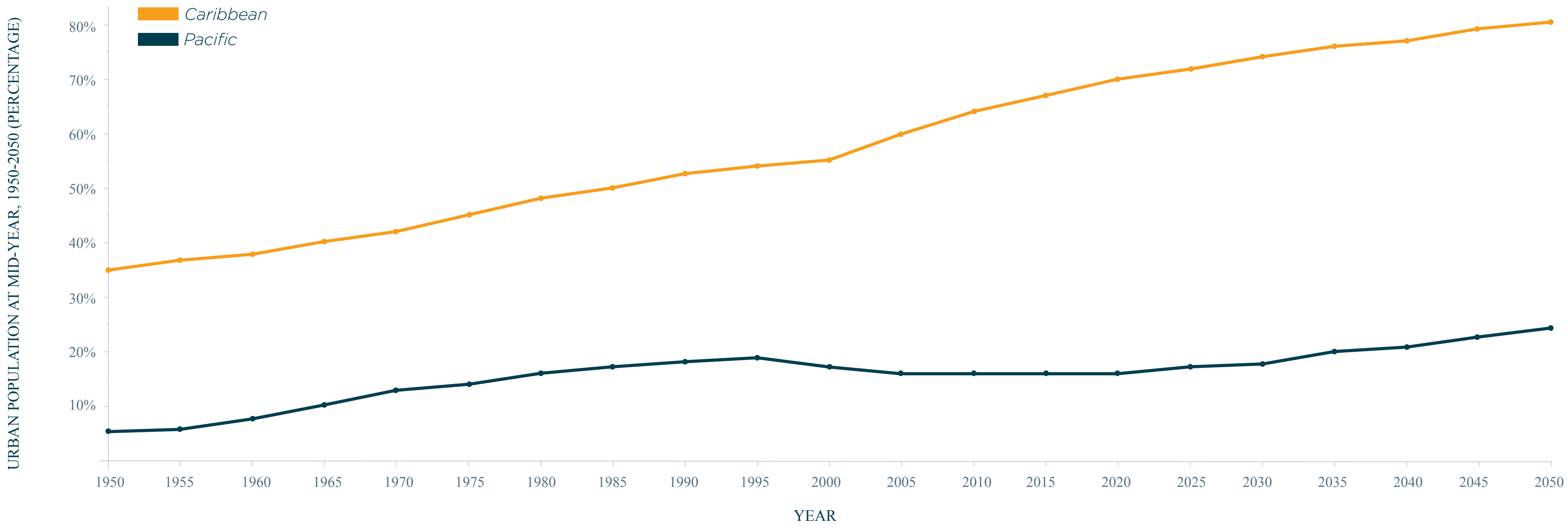


FIGURE 3.1

PERCENTAGE OF NATIONAL CARIBBEAN AND PACIFIC SIDS POPULATION IN URBAN AREAS, 1950-2050

Source: United Nations, Department of Economic and Social Affairs, Population Division (2014), World Urbanization Prospects: The 2014 Revision

SIDS have unique patterns of urbanisation that make them highly vulnerable to climate change impacts. In the future, these trends will have significant implications for adaptation strategies.

Unique urbanisation patterns include

(i) *rapid rates of urbanisation,*

(ii) *primate cities that are often located in vulnerable coastal locations,*

(iii) *LECZ cities,*

(iv) *urban centres with high levels of informal urbanism, and*

(v) *port cities that are increasingly affected by coastal squeeze.*

3.1

PROJECTED RAPID URBANISATION RATES

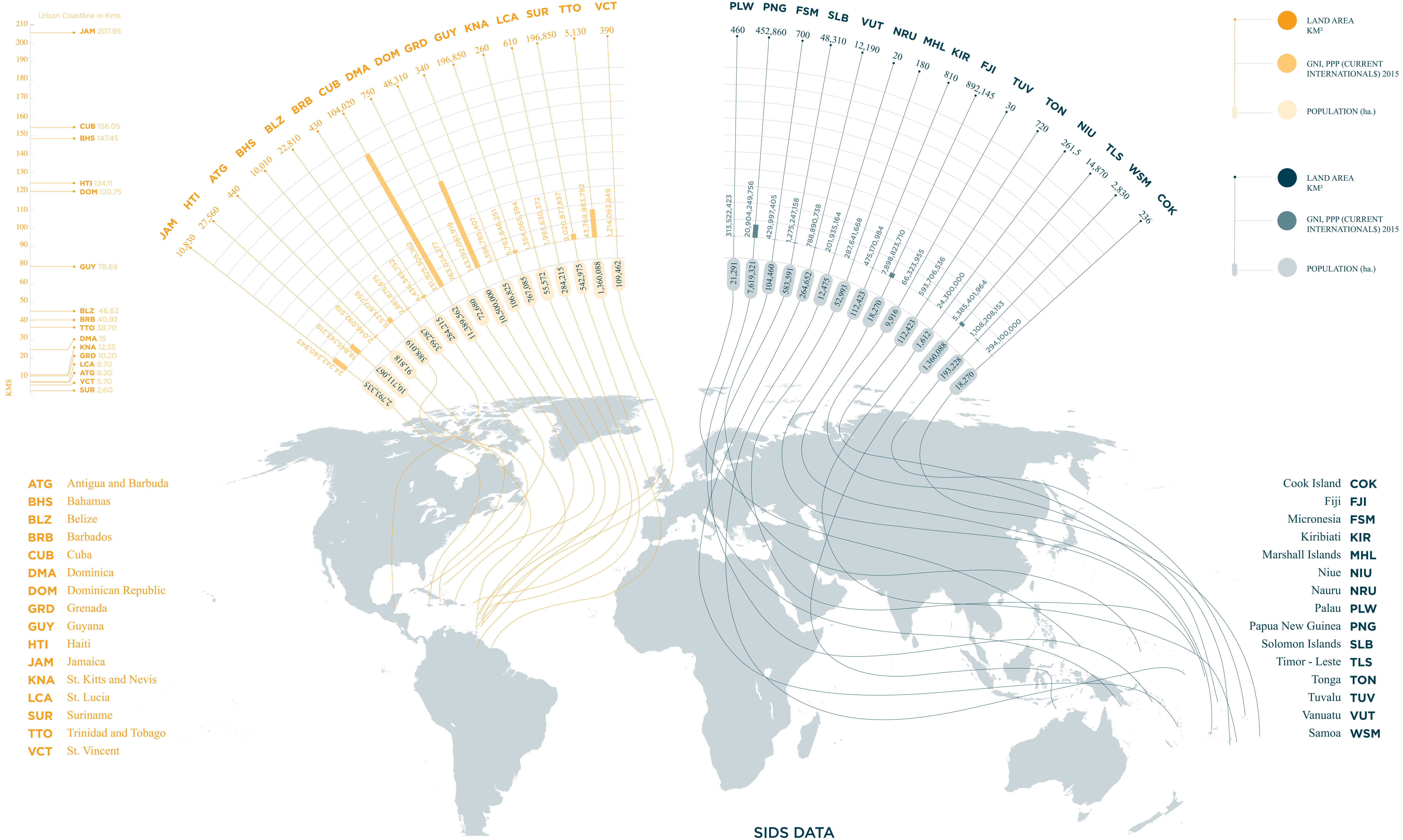
Currently, an estimated 65 million people live in SIDS of which 38 million (59 percent) live in urban settlements (UN-Habitat, 2015). Although the annual growth of the urban population in SIDS for the period 2010−15 was 1.4 percent (slightly below the global average of 1.7 percent), future rates warrant concern. Projections to 2050 provide a rapid rate of urbanisation as population growth accelerates the pressure to convert rural land for housing and economic development. The Pacific is the fastest urbanising region. The current urbanisation rate is 4.3 percent and is as high as 16 percent in peri-urban areas (UN-Habitat, 2015). By 2050, Antigua and Barbuda, Barbados, and The Bahamas will triple their rate of urbanisation and Saint Lucia and Trinidad and Tobago will experience a six-fold increase.

An increasing amount of rural land in SIDS is being converted for urban development, which necessarily entails the loss of cultivated lands (Angel, 2012). Angel et al., (2010) projected significant increases in urban land cover in Caribbean and Pacific SIDS between 2000 and 2050: Trinidad and Tobago are expected to experience a seven-fold increase in urban land cover; Fiji and New Caledonia a three-fold increase; and the Solomon Islands very high increases in conversion of rural lands to urban development.

The future of the Pacific islands will be increasingly determined by continued patterns of urbanisation, especially the ongoing growth of myriad urban village types. In 2012, the Asian Development Bank (ADB) estimated that 800,000 to 1,000,000 Pacific urban residents lived in native and traditional villages and informal and squatter settlements. By the end of 2015, this number was projected to rise to more than one million residents (ADB, 2016). The largest numbers of village-like settlements are in the Melanesian Pacific capitals—Honiara, Port Moresby, Port Vila, and Suva—and smaller towns of Micronesia, such as South Tarawa. These village-like settlements have burgeoned on land owned by customary landowners, but increasingly are on state and freehold lands, as residents seek available and affordable land and housing. Lands being occupied by settlers and village-like settlements are invariably those discarded by the formal planning system, being deemed unsuitable for properly planned urban development (ADB, 2016).

FIGURE 3.2 A

CARIBBEAN AND PACIFIC SIDS AT A GLANCE: NATIONAL POPULATION, GROSS NATIONAL INCOME AND LAND SIZE.



ATG	Antigua and Barbuda
BHS	Bahamas
BLZ	Belize
BRB	Barbados
CUB	Cuba
DMA	Dominica
DOM	Dominican Republic
GRD	Grenada
GUY	Guyana
HTI	Haiti
JAM	Jamaica
KNA	St. Kitts and Nevis
LCA	St. Lucia
SUR	Suriname
TTO	Trinidad and Tobago
VCT	St. Vincent

Cook Island	**COK**
Fiji	**FJI**
Micronesia	**FSM**
Kiribiati	**KIR**
Marshall Islands	**MHL**
Niue	**NIU**
Nauru	**NRU**
Palau	**PLW**
Papua New Guinea	**PNG**
Solomon Islands	**SLB**
Timor - Leste	**TLS**
Tonga	**TON**
Tuvalu	**TUV**
Vanuatu	**VUT**
Samoa	**WSM**

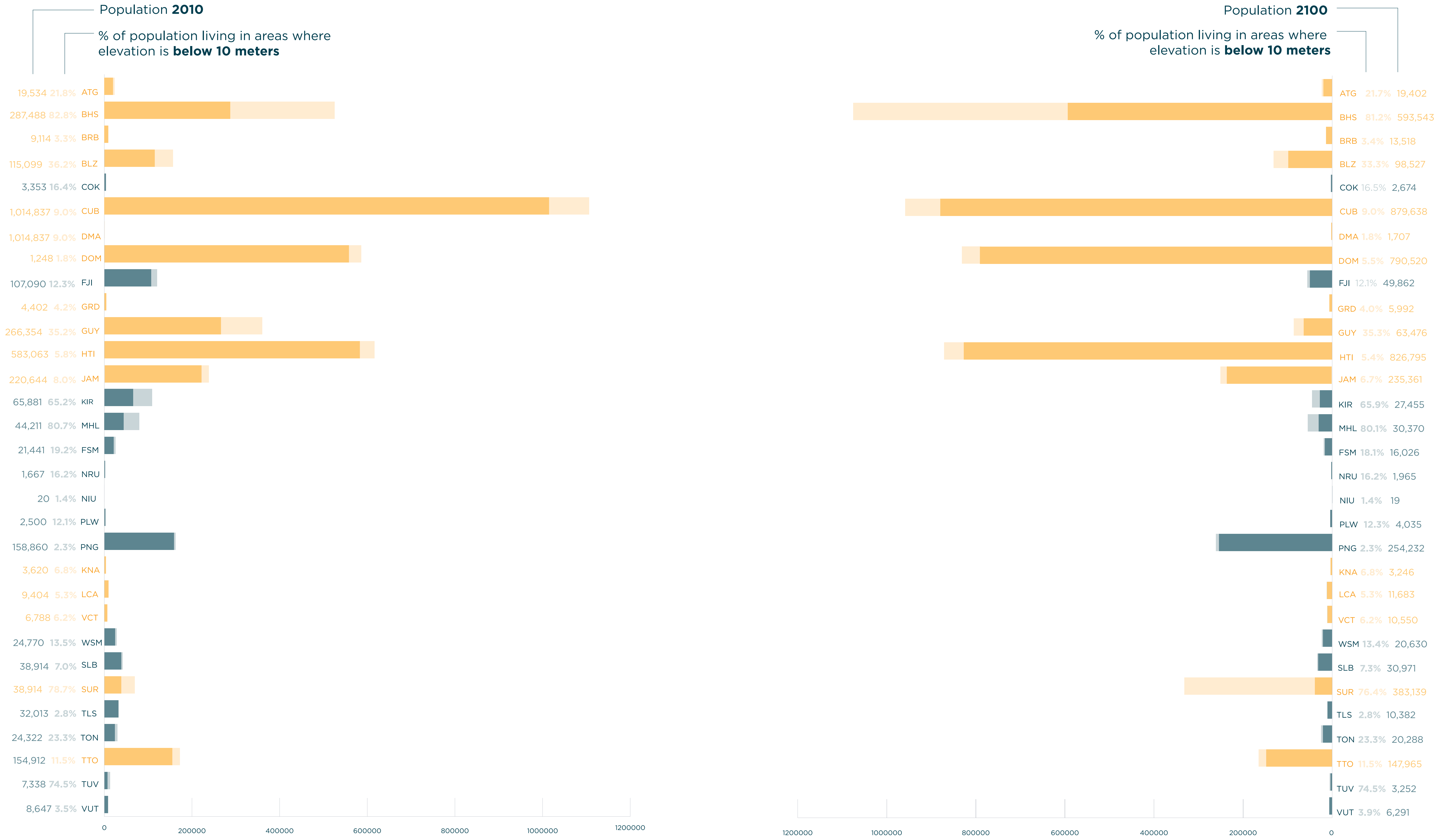
SIDS DATA

This data was included as additional information and as a consultation tool

Source: Center for International Earth Science Information Network (CIESIN)/Columbia University. 2013.

FIGURE 3.2 B

CARIBBEAN AND PACIFIC SIDS AT A GLANCE: PERCENTAGE OF POPULATION LIVING IN AREAS WHERE ELEVATION IS LESS THAN 10 METERS ABOVE THE SEA LEVEL.



Source: Center for International Earth Science Information Network (CIESIN)/Columbia University. 2013.

3.2

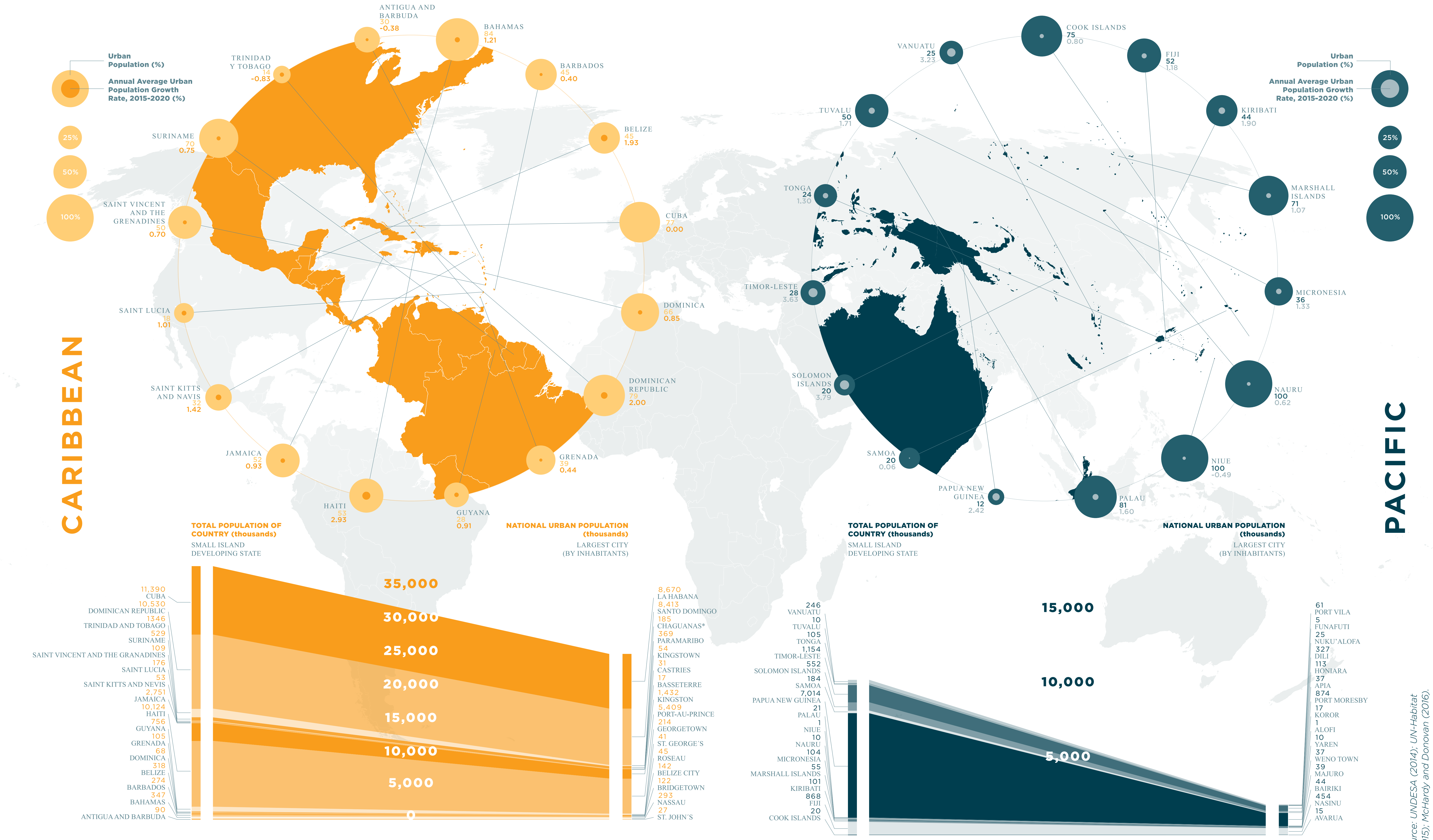
LEVELS OF URBANISATION

The level of urbanisation in some Caribbean SIDS is high (see Table 3.1). For instance, The Bahamas (79 percent), Trinidad and Tobago (72 percent), and Suriname (76 percent) are the three most urbanised countries in the region (Alkema et al., 2013). Approximately 54 percent of Jamaica's population lives in urban areas according to the 2011 Population Census, an intercensal increase of 1.9 percent. According to official statistics, 26.4 percent of Guyana's population was classified as urban in the 2011 Population Census (Guyana Bureau of Statistics, 2012). Despite the fact that Guyana is largely rural, most of its urban population lives in the capital city, Georgetown. The alternative urbanisation estimates of Alkema et al. (2013) include the considerable overspill urbanisation in the core urban region around Georgetown and an estimated urban population of 61 percent (McHardy and Donovan, 2016). In Trinidad, most of the urban population is concentrated in the urbanised East-West Corridor, which includes the capital, Port of Spain, and a number of secondary towns. Similarly, 66 percent of the urban population in Barbados lives in what is known as the Urban Corridor, stretching from the north to the south of the island.

Levels of urbanisation vary among Pacific SIDS, but on the whole they are not as high as in Caribbean SIDS. Fiji, Cook Islands, and the Marshall Islands have higher levels of urbanisation than most others (see Table 3.1).

NASSAU, BAHAMAS. PORTFOLIO ESC. HUD DIVISION. OCTOBER, 2015

FIGURE 3.3
URBAN PROFILE OF CARIBBEAN AND PACIFIC SIDS



SMALL ISLAND DEVELOPING STATE	TOTAL POPULATION OF COUNTRY (thousands)	NATIONAL URBAN POPULATION (thousands)	LARGEST CITY (BY INHABITANTS)
CUBA	11,390	8,670	LA HABANA
DOMINICAN REPUBLIC	10,530	8,413	SANTO DOMINGO
TRINIDAD AND TOBAGO	1346	185	CHAGUANAS*
SURINAME	529	369	PARAMARIBO
SAINT VINCENT AND THE GRANADINES	109	54	KINGSTOWN
SAINT LUCIA	176	31	CASTRIES
SAINT KITTS AND NEVIS	53	17	BASSETERRE
JAMAICA	2,751	1,432	KINGSTON
HAITI	10,124	5,409	PORT-AU-PRINCE
GUYANA	756	214	GEORGETOWN
GRENADA	105	41	ST. GEORGE´S
DOMINICA	68	45	ROSEAU
BELIZE	318	142	BELIZE CITY
BARBADOS	274	122	BRIDGETOWN
BAHAMAS	347	293	NASSAU
ANTIGUA AND BARBUDA	90	27	ST. JOHN´S

SMALL ISLAND DEVELOPING STATE	TOTAL POPULATION OF COUNTRY (thousands)	NATIONAL URBAN POPULATION (thousands)	LARGEST CITY (BY INHABITANTS)
VANUATU	246	61	PORT VILA
TUVALU	10	5	FUNAFUTI
TONGA	105	25	NUKU'ALOFA
TIMOR-LESTE	1,154	327	DILI
SOLOMON ISLANDS	552	113	HONIARA
SAMOA	184	37	APIA
PAPUA NEW GUINEA	7,014	874	PORT MORESBY
PALAU	21	17	KOROR
NIUE	1	1	ALOFI
NAURU	10	10	YAREN
MICRONESIA	104	37	WENO TOWN
MARSHALL ISLANDS	55	39	MAJURO
KIRIBATI	101	44	BAIRIKI
FIJI	868	454	NASINU
COOK ISLANDS	20	15	AVARUA

*The urbanisation data for Guyana and Trinidad and Tobago are official estimates but these may be undercounted.

Source: UNDESA (2014); UN-Habitat (2015); McHardy and Donovan (2016).

3.3

PRIMATE CITIES AND PRE-EXISTING VULNERABILITY

The primacy of capitals, which is the dominance of a single urban centre, is a distinct feature of SIDS (Connell and Lea, 2002). Historically, these primate cities were established in highly vulnerable locations. Many cities around the world—including in SIDS—were originally settled on dangerous sites prone to flooding and storm surges, as coastal locations were attractive for purposes of trade and territorial control (Klein, Huq, Denton, et al., 2007). These earlier settlement patterns, accompanied by the development of colonial port cities, occurred when climate change was not a global threat (Mycoo, 2014a). Today, however, the population of many of these capital cities and the support infrastructure are more vulnerable to climate change than those settled in other urban centres.

The concentration of population in the capital cities of SIDS is evident. De-capitalised urbanisation, an associated feature of urbanisation, is an urbanisation process that has occurred without infrastructural support or housing investments keeping pace with population growth. In Caribbean SIDS, six of fifteen capitals contain more than 50 percent of the country's population (see Table 3.1). Nassau, Bahamas, is host to approximately 84 percent of the country's population. Approximately 70 percent of Suriname's population resides in Paramaribo.

The primate city phenomenon is less problematic for the very small states of the Pacific. These states have a small geographic size and a less skewed distribution of population is unattainable. At least 50 percent of the population is located in the capital city in half the countries of the Pacific. In the Cook Islands, 75 percent of the population is concentrated in the capital Avarua. In Nauru, Palau, and Niue, all the population is located in the main city, which is expected because of their small land masses and the fact that they have a single city (see Table 3.1).

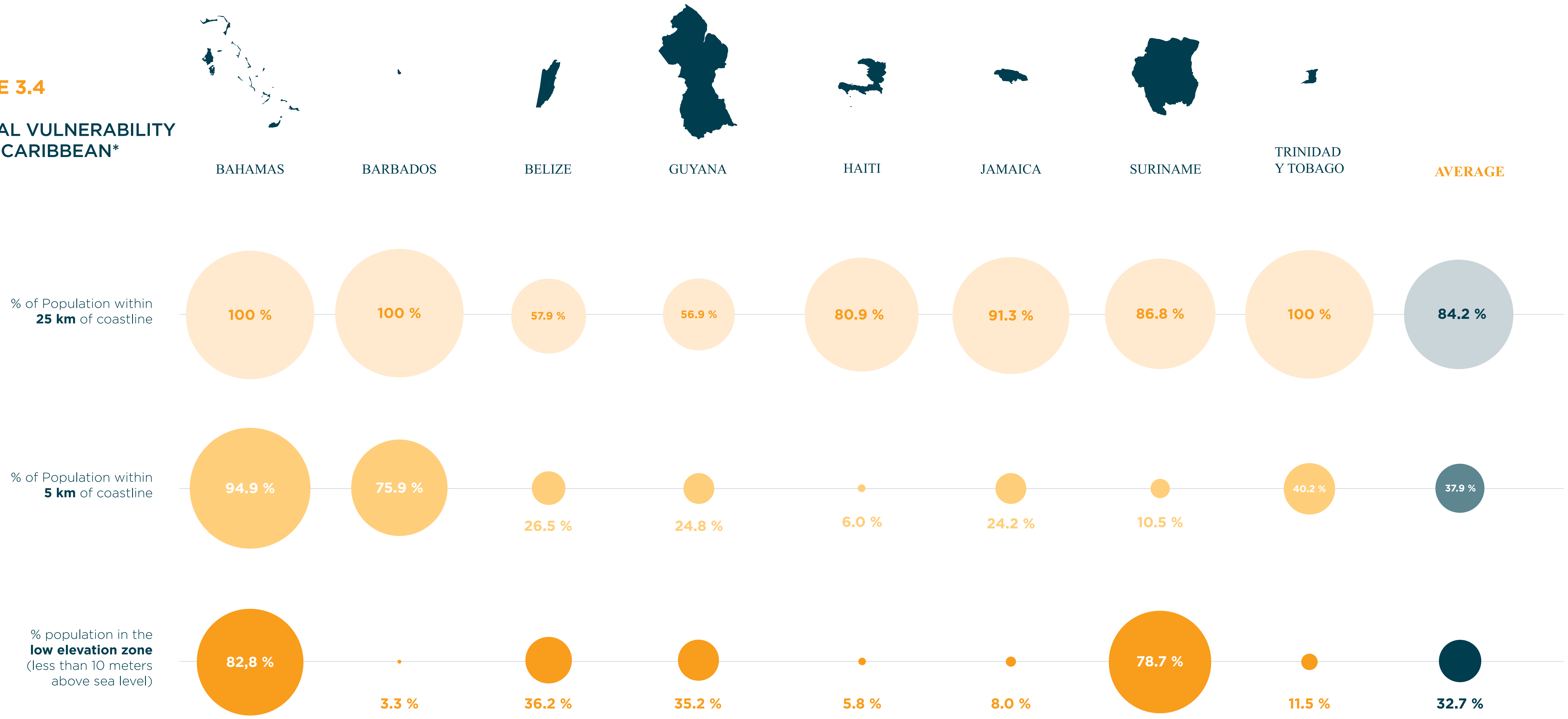
3.4

CITIES IN THE LOW-ELEVATION COASTAL ZONE

An increasing concern in some SIDS is that major cities are located in the LECZ and as a result are highly exposed to the impact of SLR. Furthermore, the risks to coastal environments and communities are projected to increase exponentially over the coming decades, exacerbated by ongoing development, resource exploitation, and increasing urbanisation of coastal cities (McHardy and Donovan, 2016). Seas are now rising faster than they have in 2,800 years, and the rate of SLR is accelerating (Kopp et al., 2016). Currently the rate of change of SLR, as measured by satellite altimeters, is 3.4 ± millimetres per year (NASA, 2017). This will be particularly harmful for communities in LECZs, such as The Bahamas, where 82.8% of the population lives less than 10 metres above the sea level and 94.9% percent live within 5 kilometres of the coastline (CIESIN/Columbia University, 2013; UNECLAC, 2014). Approximately 37.9% of the population of Bahamas, Barbados, Belize, Guyana, Haiti, Jamaica Suriname, and Trinidad and Tobago lives within 5 kilometres of the coastline (UNECLAC, 2014) and 84.2% percent live within 25 kilometres of the coastline (World Bank, 2009) (see Table 3.2). The freshwater aquifers in Belize, Guyana, and Suriname's large coastal plains are also vulnerable to saline intrusion (Marto et al., 2014).

FIGURE 3.4

COASTAL VULNERABILITY IN THE CARIBBEAN*



The Solomon Islands, Fiji, the Marshall Islands, and the Maldives also have low elevation coastal capitals. Fourteen of Fiji's 16 towns (Suva, Ba, Lautoka, Lami, Levuka, Labasa, Korovou, Rakiraki, Ba, Nadi, Navua, Nausori, Sigatoka, and Savsavu) are located in low-altitude estuaries and as a result are exposed to SLR and flooding (ADB, 2013). Likewise, some of the densest cities in the world are in Pacific SIDS, given their small country sizes and coastal density, which elevates vulnerability. For example, Ebeye in the Marshall Islands has 9,600 residents on an island the size of 1/3 of a kilometre, which translates into a density of approximately 31,000 persons per square kilometer (Republic of the Marshall Islands. 2012).

Given that many of the coastal cities of SIDS are prone to flooding, even if adaptation investments maintain constant flood probability, subsidence and SLR will increase flood losses (Hallegate et al., 2013). In most SIDS coastal cities, current defences against storm surges and flooding are designed to withstand only existing conditions, and critical infrastructure, such as wastewater treatment plants, are vulnerable[3]. However, for SIDS, protection and preparation are very important. A devastating flood in the main city could cause the country's economy to collapse. The future protection of these cities requires substantial investment in structural defences and better planning (Hallegate et al., 2013).

Informal settlement dwellers in urban areas are likely to be most affected by climate change in some SIDS. Like in most cities around the world, the poor in SIDS are most at risk because landlessness and rapid urbanisation force them to settle in highly vulnerable neighbourhoods, usually in areas prone to flooding, such as wetlands and riverbanks (see Figure 3.2). More than half of the squatter settlements in Kingston, St. Andrew, and St. Thomas, Jamaica, are within 100 metres of a waterway susceptible to flooding (Government of Jamaica, Ministry of Water and Housing, 2007).

The village-like settlements of the Pacific have imprinted themselves into the morphology of towns and cities by developing on the edges of rivers and estuaries, accretion lands on ocean and lagoon foreshores, mangrove wetlands, tidal lagoons, and swamps, which makes them highly vulnerable to climate change impacts such as SLR and flooding (ADB, 2016). Not surprisingly, the need to relocate tens of thousands of environmental refugees from urban areas due to the consequences of natural hazards and climate change impacts is, for some, an increasing possibility. Low-lying Kiribati, for example, has bought islands in Fiji for possible resettlement due to the ongoing impacts of climate change (PIPP, 2012).

**Center for International Earth Science Information Network (CIESIN)/Columbia University (2013). Population figures for low elevation coastal zones (LECZs) are from 2010. Distance from coastline figures are based on 2000 population data from CIESIN and were calculated in UNECLAC (2014) and World Bank (2009).*

[3] In Montego Bay, for example, the power plant, substations, and hotel generators lie in areas susceptible to coastal flooding. Storm surge projections for 25- and 50-year return periods point to the possibility of the inundation of the wastewater treatment plant in Bogue Village, which could cause harmful algal blooms in coastal waters and degrade ecosystems and the quality of beaches vital to tourism and Montego Bay's economy (Government of Jamaica and IDB, 2015).

11

3.5

COASTAL SQUEEZE

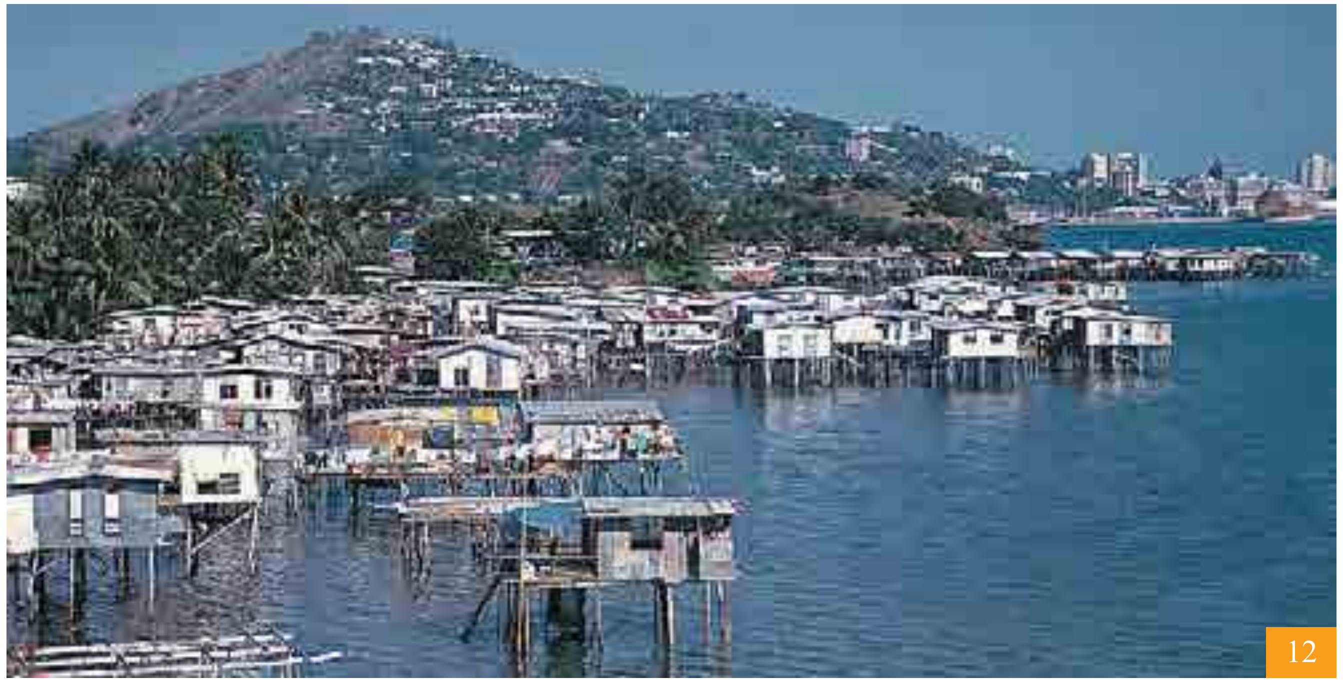
For SIDS, human development pressures on one hand, coupled with SLR and associated impacts such as erosion on the other, have created coastal squeeze. Approximately 70 percent of the Caribbean's population lives in coastal cities. In the coastal zone, seawall defences restrict expansion of cities seaward through land reclamation and inland areas are already densely populated; therefore, the population is squeezed in a narrow coastal belt. With such high concentrations of people and infrastructure located in the coastal zone, many SIDS are faced with the challenge of deciding on how best to adapt to coastal squeeze despite space restrictions and financial constraints.

PORT MORESBY
AUG 5, 2008

Source: Wikimedia Commons

3.6

PORT CITIES



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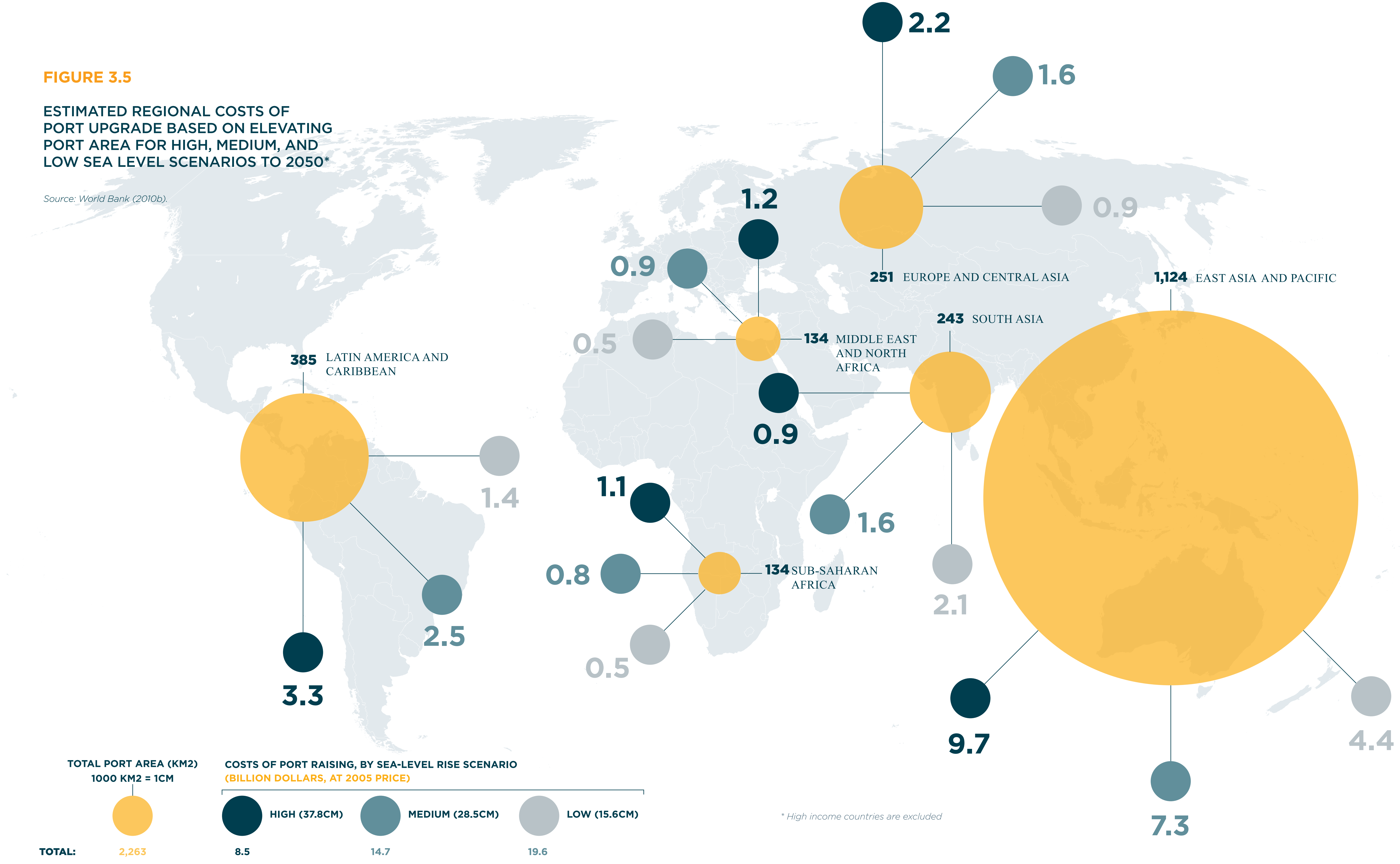
Source: Wikimedia Commons

Port cities that have not been highly vulnerable in the past are among those facing the greatest increase in risk by 2050 (Hallegate et al., 2013). The cost of the upgrade to port ground is based on the IPCC Impacts Assessment (1990), which estimated approximately US$15 million per square kilometre to raise ground levels by 1 metre (Nicholls and Tol, 2006). Applying these estimates revealed that LAC will incur the second highest costs by region under the high, medium, and low SLR scenarios to 2050 (see Table 3.3). Costs range between US$1.4 billion and US$3.3 billion. The cities of Bridgetown, Barbados; Kingston, Jamaica; Castries, Saint Lucia; and Kingston, Saint Vincent, were all developed as colonial ports for trade and commerce. Among the leading cities with the greatest increase in risk is Santo Domingo, Dominican Republic (Hallegate et al., 2013). Figure 3.3 shows the exposure of transportation infrastructure in Honiara, The Solomon Islands.

FIGURE 3.5

ESTIMATED REGIONAL COSTS OF PORT UPGRADE BASED ON ELEVATING PORT AREA FOR HIGH, MEDIUM, AND LOW SEA LEVEL SCENARIOS TO 2050*

Source: World Bank (2010b).

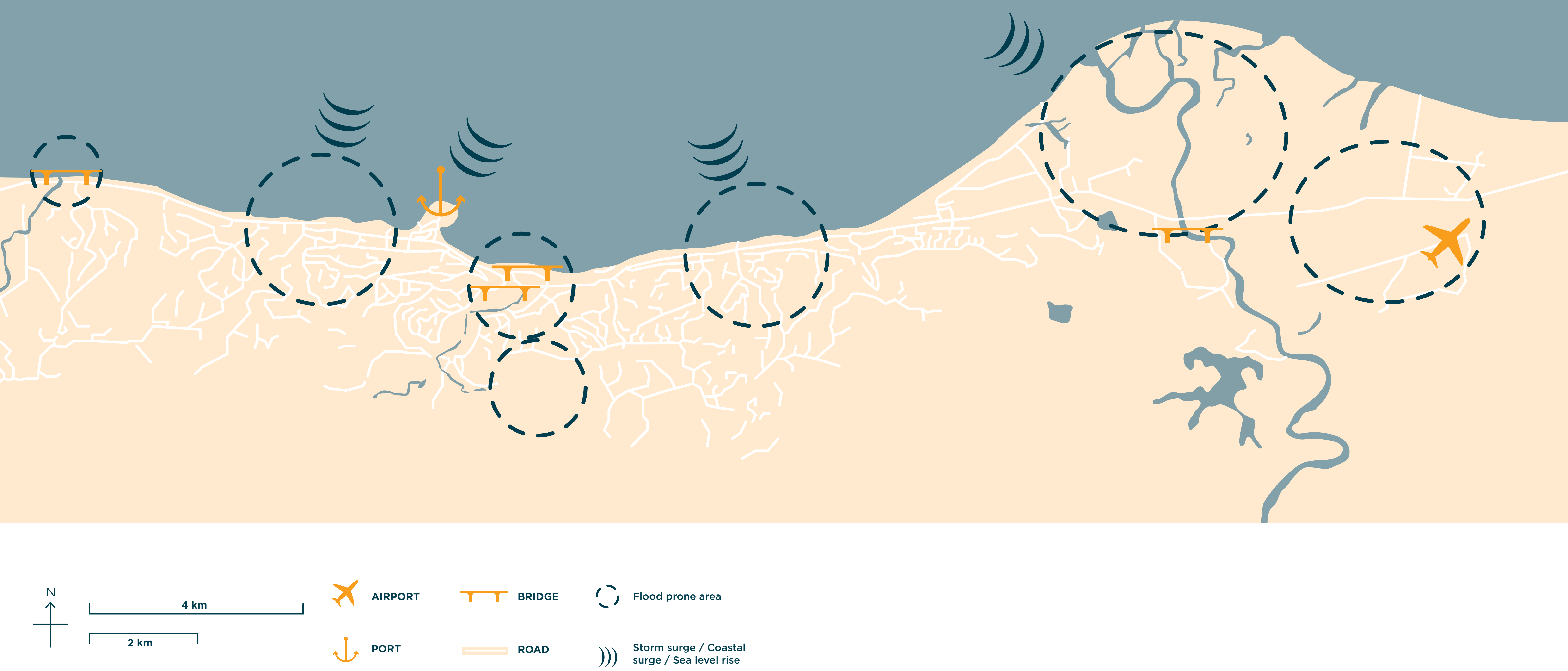


** High income countries are excluded*

FIGURE 3.6

EXPOSURE OF INFRASTRUCTURE IN HONIARA, SOLOMON ISLANDS

Source: UN-Habitat (2015).



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4.2

ADAPTATION STRATEGIES

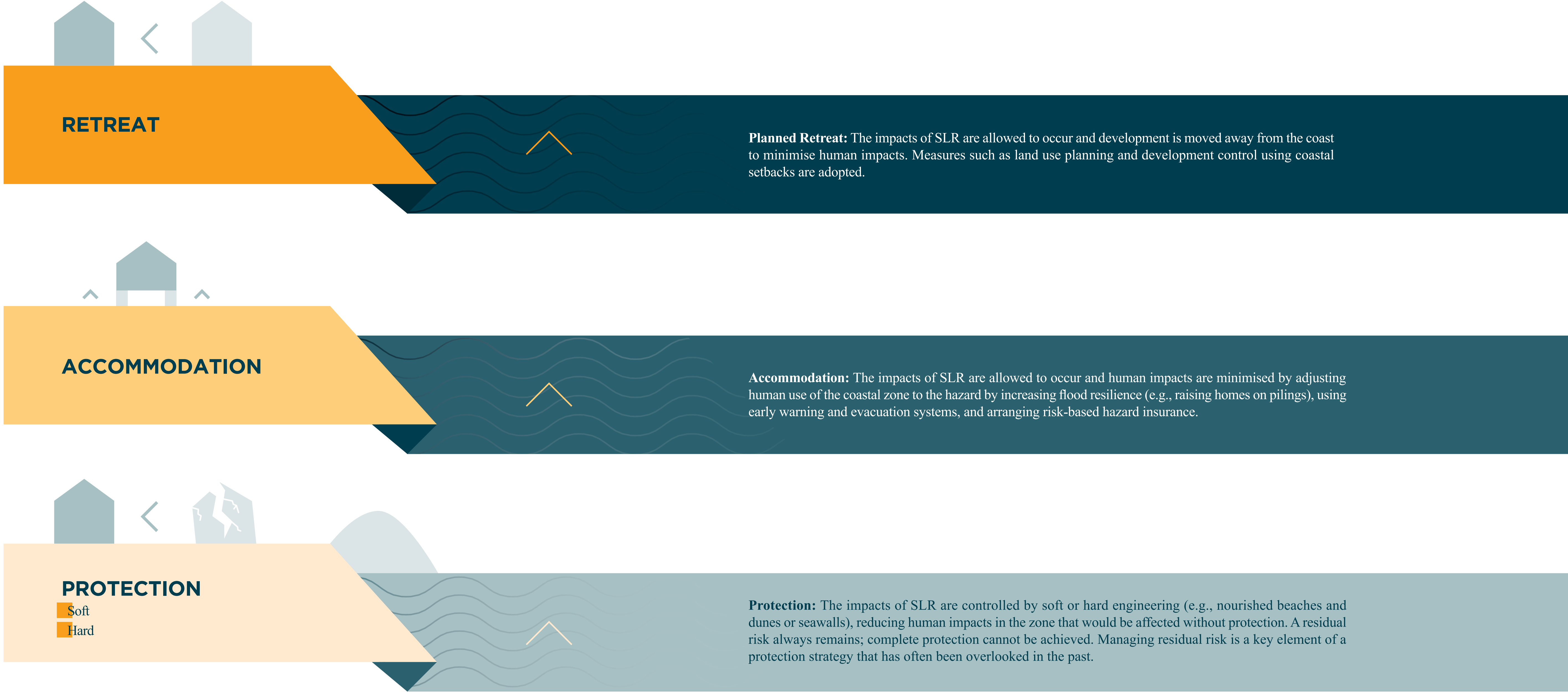
In SIDS, protection, planned retreat, and accommodation are the three main strategies that have been used to adapt to climate change. These strategies are described below and shown in Figure 4.1.

Protecting and maintaining the functionality of coastal ecosystems depends on a country's adaptive capacity and cities' capacity to maintain core functions in the face of hazard threats and impacts, especially for vulnerable populations. The resilience of any population group to climate change interacts with its resilience to other dynamic pressures, including economic change and social conflict. A series of policy options are provided in Figure 4.2.

FIGURE 4.1

RESPONSES TO CLIMATE CHANGE IN COASTAL AREAS

Source: Van Koningsveld, Mulder, Stive et al. (2008).



Planned Retreat: The impacts of SLR are allowed to occur and development is moved away from the coast to minimise human impacts. Measures such as land use planning and development control using coastal setbacks are adopted.

Accommodation: The impacts of SLR are allowed to occur and human impacts are minimised by adjusting human use of the coastal zone to the hazard by increasing flood resilience (e.g., raising homes on pilings), using early warning and evacuation systems, and arranging risk-based hazard insurance.

Protection: The impacts of SLR are controlled by soft or hard engineering (e.g., nourished beaches and dunes or seawalls), reducing human impacts in the zone that would be affected without protection. A residual risk always remains; complete protection cannot be achieved. Managing residual risk is a key element of a protection strategy that has often been overlooked in the past.

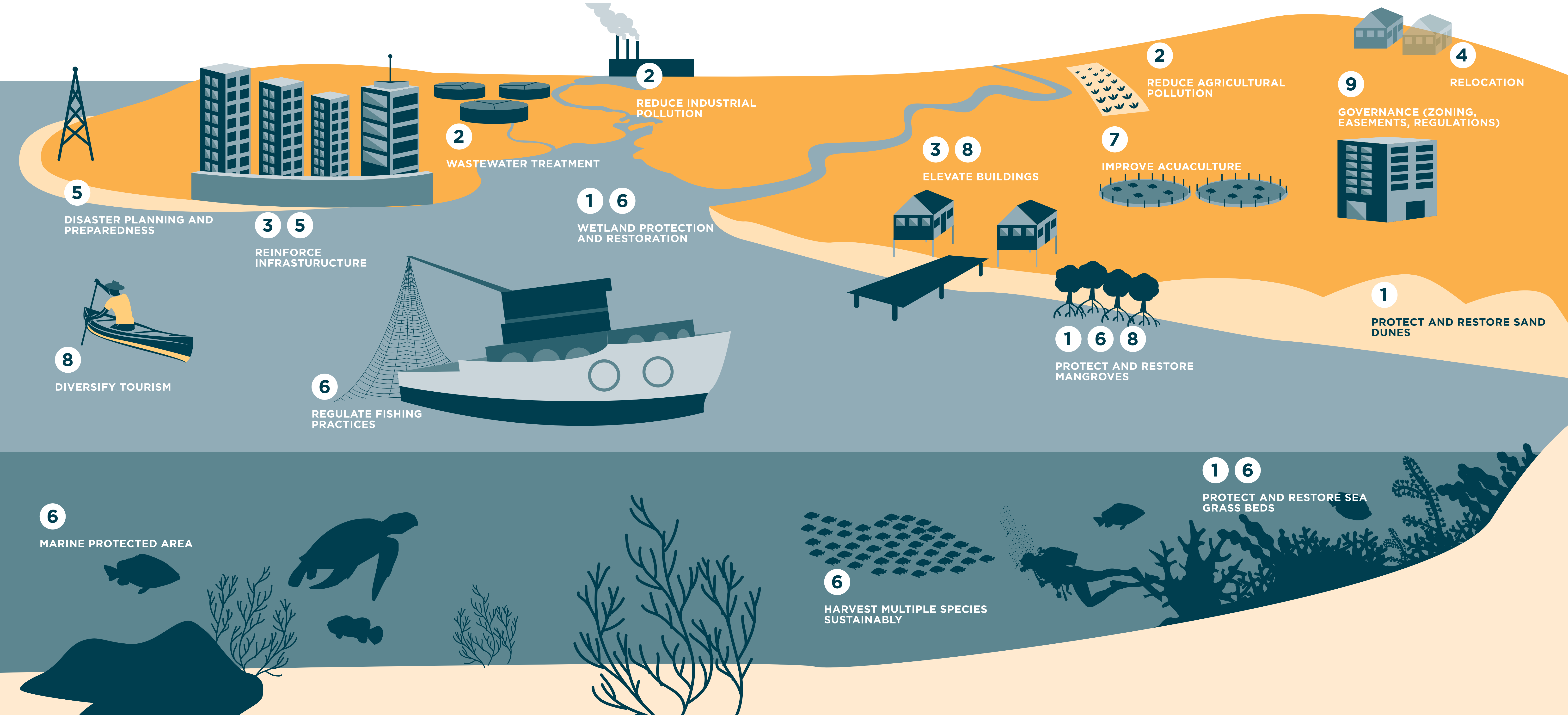
FIGURE 4.2

COASTAL ZONE ADAPTATION OPTIONS

Source: USAID (2015).

Adaptation Actions

- ① Restore and protect coastal ecosystems
- ② Reduce non-climate stressors that degrade coastal ecosystems
- ③ Protect infrastructure and assets
- ④ Relocate infrastructure and assets
- ⑤ Disaster prevention, planning, and preparedness
- ⑥ Protect and manage fisheries
- ⑦ Protect and manage aquaculture
- ⑧ Adapt tourism planning and operations
- ⑨ Strengthen coastal governance



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NASSAU, BAHAMAS
OCT, 2015

Source: IDB photogallery.

Resilience refers to a capacity to withstand shocks or stresses and to recover from the unexpected (Satterwaithe and Dodman, 2013). This definition of resilience is embraced by interdisciplinary researchers such as urban planners, geographers, ecologists, and environmental studies specialists; however, it is not adopted by sociologists, economists, politicians, and anthropologists (Olsson, Jerneck, Thoren, et al., 2015). Interdisciplinary researchers that study adapting to climate change and reducing disaster risk promote the social-ecological resilience paradigm. They state that resilience is the outcome of successful adaptation, which is a product of governments, enterprises, civil society organisations, households, and individuals with strong adaptive capacity. (UN-Habitat, 2011a).

According to Olsson et al. (2015), the concept of resiliency has attracted criticism from some researchers. Owing to its malleability in science combined with its popularity among powerful private and public actors, there is a risk of (un)intentional scientific justification of particular policies, projects, and practices (Olsson et al., 2015). This fosters a tendency in resilience theory to depoliticise social change (Reid, 2013), as in a recent example where poverty is seen as a stochastic dynamic process (Barrett and Constas, 2014) rather than the outcome of political and structural processes. To exemplify this, resilience is increasingly adopted by influential global organisations such as the United Nations Development Programme (UNDP) and funding institutions such as the Rockefeller Foundation (Boltz, 2014) as a basis for policymaking and deployment of funds. This trend has stirred controversial arguments among some researchers. For instance, Olsson et al. (2015) suggest that, at best, it is inappropriate to promote resilience in policymaking and funding regimes concerned with development and sustainability transitions where issues of power, conflict, and agency are generally considered central. They contend that, if oppressive power or a denial of agency cannot be questioned, it is unlikely that they can be understood, much less changed (Olsson et al., 2015).

In practical terms *city resiliency* is more than identifying and acting on specific climate change impacts. It usually requires a capacity to anticipate climate change and plan needed adaptations. It looks at the performance of each city's complex and interconnected infrastructure and institutional systems, including interdependence between multiple sectors, levels, and risks in a dynamic physical, economic, institutional, and socio-political environment (Gasper, Blohm, and Ruth et al., 2011; Kirshen, Knee, and Ruth et al., 2008). When resilience is considered for cities, certain systemic characteristics are highlighted, such as flexibility, redundancy, responsiveness, capacity to learn, and safe failure (Brown, Dayal, and Rumbaitis et al., 2012; da Silva, Kernaghan, and Luque et al., 2012; Moench, Tyler, and Lage et al., 2011; Tyler, Reed, MacClune et al., 2010). Resiliency also takes into account the multiple interdependencies between different sectors.

Few SIDS have paid much attention as to how their cities may be made resilient. One reason for this oversight is that national climate change policies usually pay little attention to adaptation in the urban sector compared to sectors like agriculture and water. The ministries or agencies responsible for these policies often have limited involvement in urban planning and city governance. Another reason is that the policy and politics interface is challenging in the urban context and policymakers are grappling with how to move from reducing vulnerabilities through adaptation and resiliency to transformation, as described by Pelling (2011). In cases where city vulnerability is currently high, transformational adaptation may be needed to respond to changes in climate and climate variability. In the absence of ambitious mitigation efforts, the impacts of climate change can be expected to increase dramatically from the second half of the 21st century onward. In this case, transformational adaptation may be required in advance of disruptive impacts to reduce risks and vulnerabilities (Kates, Travis, and Wilbanks et al., 2012).

Transformational adaptation includes actions that change the fundamental attributes of a system in response to actual or expected impacts of climate change. These may involve adaptations at a larger scale or greater intensity than previously experienced, adaptations that are new to a region or system, or adaptations that transform places or lead to a shift in the location of activities (Kates et al., 2012). Such transformations are expected to occur when the rate and magnitude of climate change threatens to overwhelm the resilience of existing systems or when vulnerability is high (Kates et al., 2012). Transformational change can be considered a means of reducing risk and vulnerability, not only by adapting to the impacts of climate change, but also by challenging the systems and structures, economic and social relations, and beliefs and behaviours that contribute to climate change and social vulnerability.


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Source and author: Gabriel Arboleda

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4.3

ADAPTATION STRATEGIES IN THE CARIBBEAN

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HIGH TIDE AT THE SEA WALL, GUYANA. APRIL 29, 2013

Source: Stabroeknews

The geographies of SIDS cities vary in terms of elevation, topography, and land cover, but they are similar in population characteristics and the distribution of critical physical and social infrastructure. These features have dictated the types of adaptation strategies used to defend their coastal cities. The following are examples of adaptation strategies and a critique of existing adaptation measures used in the Caribbean.

4.3.1

PROTECTION (HARD-ENGINEERING)

In the Caribbean, protection, which involves a hold-the-line approach, has been used to maintain or introduce new defences that absorb wave energy and minimise coastal erosion and flooding. For example, in Barbados, coastal engineering (funded by the Inter-American Development Bank [IDB]) has been used to protect the more highly developed southwest and west coasts, where erosion is common (Brewster, 2007; Fish, Côté, Horrocks, et al., 2008). The seawalls built in Georgetown, Guyana, (see Figure 4.3) are also examples of the hold-the-line approach used to address coastal flooding and SLR. The cost of coastal protection in Guyana is US$2,000 for a 100-metre compacted dyke and US$350,000 for a 100-metre rock armour (Anthony and Gratiot, 2012).

Hard engineering has some disadvantages. For example, seawalls are costly to build and maintain. The estimated capital costs for sea dykes in LAC under the medium sea level scenario (from the 2010s through to the 2040s) is US$7.1 billion per year (World Bank, 2010b). In LAC, these structures cost more than in other regions of the world.

In addition, although coastal engineering may minimise erosion along some shorelines, it may deprive other sites of sediment, therefore disturbing the coast's equilibrium. Furthermore, because seawalls are immovable defences, they can interfere with natural processes such as habitat migration, which is naturally induced by changes in the sea level. Seawalls can cause coastal squeeze, a process that reduces the area of intertidal habitats such as sandy beaches because these environments are trapped between a rising sea level and unmoving, hard defences (Zhu, Linham, and Nicholls, 2010).

Barbados provides important lessons in the use of hard engineering. Stakeholders applied political pressure to hold the line rather than use managed realignment because of fear of property losses and non-compensation. This is consistent with the view of Pulwarty, Nurse, and Trotz (2010), who argued that the measures to adapt to climate change and SLR depend on the public and a country's leadership. Under Barbados' Coastal Infrastructure Programme, shoreline stabilisation and erosion control have been major priorities (Zhu et al., 2010). Coastal defences, built using hard engineering, have been the preferred option in the short term because they have an immediate positive impact on protecting the coastal zone from erosion and flooding. In short, using engineering to protect coastal areas in SIDS depends on the degree of coastal vulnerability and the urgency of mitigating and adapting to climate change impacts.

4.3.2

PLANNED RETREAT

A few Caribbean SIDS are using planned retreat because it minimises environmental impact. Trinidad, Barbados, and Saint Lucia are applying coastal setbacks, land use zoning policies, and environmental impact assessment to steer development further inland. However, such measures require regular monitoring and maintenance, as well as the ongoing involvement of engineers, planners, and marine biologists to a greater degree than hard defences. Hence, additional costs and human resource capacity should be considered when selecting such options.

Governmental efforts to limit coastal zone development generally involve land acquisition, land-use restrictions, prohibited reconstruction of property damaged by storms, and reductions in subsidies and incentives for development in vulnerable coastal areas.

In some Caribbean SIDS, there has been a long history of coastal setbacks for military purposes that have been retained and that enable the state to regulate coastal development. Saint Lucia is unique in its capacity to manage coastal land development conflicts because 13 percent of all crown land comprises a coastal reserve of 57 metres measured inland from the high watermark (Mycoo, 2005). Using the *Three Chains Act*, which allows a coastal reserve of 60.35 metres from the high-water mark, the government of Trinidad and Tobago successfully enforced coastal development regulations in Tobago (Mycoo, 2002). In the Pacific, Fiji's *Environmental Management Act* (2005) requires all built development to have a 30-metre setback from the high-water mark.

Coastal setbacks have long been a policy of planning agencies in the Caribbean. Coastal setbacks are *"prescribed distances to a coastal feature such as the line of permanent vegetation, within which all or certain types of development are prohibited"* (Cambers, 1998). Setbacks have several advantages over traditional engineering structures. From an ecological perspective, they provide a buffer area that can simultaneously accommodate the naturally dynamic nature of the coast. From an economic perspective, they provide protection for coastal property from the immediate impacts of storm waves and provide a low-cost alternative to shoreline erosion or flood protection such as seawalls (Zhu et al., 2010).

Barbados has a national statute, which predates climate change discussions, that established a minimum building setback for all new buildings along sandy coasts of 30 metres from the mean high water mark. Along cliffs, the setback is 10 metres from the under portion of the cliff. For Barbados, one objective is to ensure that built development is located away from the zone of risk where coastal erosion and flooding occur (Mycoo, 2006).

While the benefits in terms of long-term beach maintenance accrued from adequate setback regulations are clear, consideration must also be given to issues that can hinder the implementation or effectiveness of setbacks (Fish et al., 2008). Currently, using the mean high water mark can create problems because the position of this marker varies from day to day. Planners and developers may therefore have different interpretations of the setback distance.

Managed realignment, which involves relocating existing buildings, is considered a type of planned retreat. This is another option available to SIDS, although it is difficult to implement. In Caribbean SIDS, such as Barbados, substantial investment in property has been made on highly developed coasts. Stakeholders resist abandoning high-value real estate unless the cost–benefit analysis and, more significantly, political will suggest otherwise. Furthermore, realignment is constrained by the small landmass of SIDS, which limits the extent to which coastal properties can be built further inland. In operationalising managed realignment in Barbados, relocating buildings and implementing setback distances are possible only if an extreme event damages existing buildings.

4.3.3

ACCOMMODATION

In accommodation, building codes for critical buildings are adjusted to take into account the need for ground elevation and flood proofing. The Caribbean Development Bank (CDB) funded the development of a Caribbean Uniform Building and Infrastructure Code, but implementation of the code has been challenging for countries in the Organisation of Eastern Caribbean States (OECS) and Trinidad and Tobago because of the lack of enforcement capacity at the local authority level. Donors such as the US Agency for International Development (USAID) have funded the construction of hurricane-resistant housing, hospitals, schools, and shelters. In some countries, the need to recover quickly in the aftermath of hurricanes has resulted in the quick erection of buildings without regard to hurricane resistant building standards (Mycoo, 2011b). Another good practice in adopting accommodation as an adaptation strategy is elevating infrastructure. For example, pump stations in Guyana were elevated as a result of accepting the reality that flooding on a massive scale will take place.

BOX 4.1

MINIMUM STANDARDS FOR CONSTRUCTING/ RETROFITTING HOMES TO WITHSTAND HURRICANE WINDS UP TO 130 MPH (CLASS III HURRICANE)

A Foundation

- Solid cement or concrete pillars firmly embedded 18 inches (") into ground with 1/2" steel reinforcement bar extending 12-14" (300-350mm) above foundation, or wooden pillars (minimum 6"x6" or 8" diameter) of treated lumber, sunk more than 4 feet into the ground

Architectural design e.g. building on stilts (pilings) and leaving open ground levels on housing lots have been widely used in the Caribbean (See Figure 4.3). In earlier times, they were part of the traditional architecture of SIDS and helped in adapting structures to flood prone characteristics of settlements. In Georgetown, Guyana many of these open bottom houses were replaced by enclosing the ground floor, but many properties were flooded during heavy rains (See Figure 4.4).

B Walls

- Wall plate/still attached to foundation/pillars by minimum 12cm anchor bolts or
- Wall plate/still attached to wooden pillars by straps and nails
- Floor joists toe-nailed to wall plate
- Wall uprights (studs) fixed to sill and top wall plate with hurricane straps
- Wall uprights located at 2' 0" centres
- Double studs around doors and windows; cross braces at corners

C Roof

- Hip or gable shaped roof with at least a 22-30° slope
- Overhang NTE 8" unenclosed or 18" enclosed
- Ventilation installed in gable ends facing away from the hurricane winds
- Rafters attached to wall plate with twisted metal straps
- Rafters located at centres NTE 2' 0"
- Every second set of rafters connected by collar ties beneath the ridge board
- Cross-laths (purlins) located at centres NTE 2' 0"
- Galvanised sheets of ideally 24 gauge and no thinner than 26 gauge
- Galvanised sheets to overlap longitudinally at least one complete corrugation and laterally 6-8"
- Galvanised sheets nailed at top of every corrugation at eave and ridge board and every second corrugation on lath/purlins
- Ridge capped and nailed at every corrugation
- Dome head galvanised nails or washered bolts for roofing
- Patio/veranda roof separate from house roof

D Windows/Doors

- Shutters made and attached for rapid closing or shutters pre-made and stored to be nailed in place before storm strikes
- Family trained to either keep all entrances closed throughout storm period and/or open entrances on opposite sides of house to allow air pressure to neutralise

Source: USAID and OAS (1999).


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4.3.4

INTEGRATED COASTAL ZONE MANAGEMENT

Integrated coastal zone management (ICZM) was used in Caribbean SIDS to minimise coastal erosion and flooding long before issues such as climate change impacts and resiliency building emerged in policy discussions and decision-making. Barbados provides an example of a well-functioning ICZM unit. The unit not only addresses inland issues such as land degradation, but also coastal issues such as mangrove depletion, coral reef degradation, coastal flooding, and erosion. The entire island is seen as the coastal zone in many SIDS and, currently, more efforts are being made to address climate change from an integrated perspective. This involves incorporating watershed management with planning and managing the coast. Belize has established an ICZM, the British Virgin Islands has adopted ICZM, and despite earlier shortcomings, Trinidad and Tobago is working to establish such an integrated approach to coastal management (Mycoo, 2002).


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4.3.5

URBAN PLANNING

Urban planning regulations and standards are a critical component of adapting cities to climate change and strengthening their resiliency to impacts. In some Caribbean SIDS, weak planning systems have resulted in a high percentage of unauthorised buildings that do not adhere to building codes, site development standards, and density regulations. Enforcing regulations in the Anglophone Caribbean is problematic because most regulations are based on outdated and inappropriate planning legislation or urban planning codes that were inherited from colonial times (Mycoo, 2016). The lack of political will has undermined efforts to implement a national building code. For example, the weak enforcement capacity of the Central Housing and Planning Agency in Georgetown, Guyana, has exacerbated flooding in the city (Mycoo, 2014a).

In Trinidad, the public criticised the development control process for being lethargic and rigid (Amos, 1988). Between 2002 and 2014, the percentage of applications processed within the eight-week statutory period steadily declined from 61.3 percent in 2002 to 41.1 percent in 2014 (Mycoo, 2016a). McHardy (2002) confirmed that Jamaica also suffered from administrative shortcomings. The subdivision approval process was lengthy, averaging 171 days, resulting in high development costs and encouraging approximately 75 percent of development to circumvent the formal approval process (McHardy, 2002).

Ineffective urban planning, inherited land tenure systems from colonial times (Mycoo, Griffith-Charles, and Lalloo, et al., 2016), and dysfunctional land markets in the Caribbean have also affected the land and housing sectors. Most land and housing in the main cities is unaffordable for the majority of the poor (Donovan, 2014). In 2014, approximately 60 percent of applicants on Trinidad and Tobago Housing Development Corporation's application list had a joint monthly income of US$1,393 or less (Rajack and Frojmovic, 2016) and were unable to service a mortgage at prevailing rates due to insufficient income. This is the result of housing prices rising faster than wages between 1991 and 2006 and between 2010 and 2013. Furthermore, a mismatch exists between supply and demand for affordable, serviced land and housing in suitable locations (Rajack and Frojmovic, 2016). For the past two decades, the house price to wages ratio in Trinidad and Tobago has averaged 10:1, reaching a peak of approximately 20:1 in 2006–07 (McHardy and Donovan, 2016).

With inflated land prices and unaffordable housing, the poor have gravitated to marginal hazard-prone lands near the city (McHardy and Donovan, 2016). Informal settlements have become widespread in Caribbean cities such as Kingston (Jamaica), Port of Spain (Trinidad), Georgetown (Guyana), Port-au-Prince (Haiti), and Santo Domingo (Dominican Republic). Approximately ten million people in The Bahamas, Barbados, Cuba, Dominican Republic, Guyana, Haiti, Jamaica, St. Lucia, Suriname, and Trinidad and Tobago experience a housing deficit and building adequate housing for this population would cost about $18 billion (Donovan and Turner-Jones, 2017). –A recent study showed that there are over 750 squatter settlements in Jamaica, with 600,000 people, or 20 percent of the population, living in them (Government of Jamaica, Ministry of Water and Housing, 2007). Squatter settlements are of three main types: agricultural, commercial, and residential, with the majority being residential; 82 percent are in urban areas (McHardy and Donovan, 2016). Approximately 65,000 people live in informal settlements in Trinidad, one-fifth of which occupy lands in the Greater Port of Spain (Beard, 2012)[4]. Between 2009 and 2012, there was an increase of squatter sites by 37 percent (Mycoo and Bharath, 2016). In Trinidad, the Land Regularisation Unit of the Land Settlement Agency estimated a cost of US$2.72 million to regularise these sites.

In some Caribbean territories, physical development plans have been revised infrequently. Examples where this is common are Jamaica, Guyana, and Saint Lucia (Mycoo, 2016). The result of outdated plans and political intervention in decision-making that overrides planning authorities is that permission is granted to develop rural lands where agricultural activity is predominant. This has increased urban sprawl in the Caribbean and contributed to high levels of traffic congestion and air pollution as commuters travel to the main employment centres, which are invariably located in the capital cities.

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[4] *More recent data confirmed that 22 percent of squatter households are located in this area (Bharath, 2016).*

4.3.6

ECOSYSTEM-BASED ADAPTATION

EBA is emerging as a viable option for local and national governments to increase urban resilience to climate change. EBAs (or "no regret or low regret" approaches to adaptation) tend to be more cost-effective than engineering options in protecting coastal areas. In the long term, EBAs are easier to maintain compared to engineering structures used in coastal protection. Additionally, EBA ensures ecosystems remain healthy. A healthy ecosystem allows local populations to benefit from the provided environmental services, such as clean water, improved habitat for fish supplies and, more notably, protection from extreme weather events (UN-Habitat, 2015). Examples of EBAs widely used in SIDS are watershed management by re-afforestation, replanting mangroves, conserving wetlands, and restoring coral reefs in coastal areas. These projects have been undertaken by national governments and are often funded by UNEP and GIZ, which focuses on environmental management approaches using communities to adapt to climate change and build resiliency. This approach presents opportunities for poorly funded agencies and non-traditional agencies to take action which is in keeping with the COP 21accord.

4.4

ADAPTATION STRATEGIES IN THE PACIFIC

Like Caribbean SIDS, those in the Pacific have used a combination of adaptation strategies. The approach is holistic in that it departs from standalone strategies and often involves a synthesis of physical works as well as processes to enhance stakeholder involvement. Table 4.1 provides a summary of commonly proposed and applied climate change adaptation strategies in the Pacific.

Donner and Webber (2014) categorised these strategies and measures and highlighted in what circumstances they were applied. In addition, they researched the cost of applying them and critiqued the limitations of using them. Table 4.2 summarises their research on obstacles to decisions about adapting to climate change.

TABLE 4.1

COMMONLY PROPOSED CLIMATE CHANGE ADAPTATION STRATEGIES IN THE PACIFIC ISLANDS

Source: Donner and Webber (2014).

Strategy	Primary Benefits	Common Application
Anticipatory decision making	Greater capacity to be deliberate and, therefore, coordinate and ensure equitable decisions are made	Large infrastructure investments (e.g., coastal protection)
Mainstreaming	Enables the processes of development, adaptation, and disaster risk planning to proceed together	Development of institutions, policies, and management plans
No regrets or “win-win”	Stresses co-benefits of adaptation measures; politically expedient	Public services (e.g., water treatment sewage) and ecosystem conservation
Community based	Draw on local knowledge, experience, and resources	Small-scale projects (e.g., creating marine-protected areas, (re)planting mangroves)
Manage for resilience	Learn from past mistakes and increase ability to absorb shocks	Similar to above

TABLE 4.2

SUMMARY OF ADAPTATION TECHNIQUES USED BY CARIBBEAN AND PACIFIC SIDS

Source: Authors.

● “HARD” PROTECTION
● “SOFT” ACCOMMODATION
● MIGRATION

MEASURE: SEAWALLS	**Applicability:** Erosion and inundation	**Cost:** High	✓ **Caribbean SIDS**	✓ **Pacific SIDS**	Resource needs; slow to implement; may lead to beach loss; poor design leads to overtopping; ongoing maintenance
MEASURE: LAND RECLAMATION / ARTIFICIAL ISLANDS	**Applicability:** Erosion and inundation	**Cost:** High	✓ **Caribbean SIDS**	✓ **Pacific SIDS**	Material needs; engineering demands; ongoing maintenance
MEASURE: BREAKWATERS	**Applicability:** Erosion	**Cost:** High	✓ **Caribbean SIDS**	✓ **Pacific SIDS**	Resource needs; slow to implement; alters hydrodynamics
MEASURE: GABION BASKETS	**Applicability:** Erosion and inundation	**Cost:** Low to moderate	✓ **Caribbean SIDS**	✓ **Pacific SIDS**	Prone to damage and overtopping; ongoing maintenance; not suitable in high-energy environments
MEASURE: GROYNES	**Applicability:** Erosion	**Cost:** Low to moderate	✓ **Caribbean SIDS**	✓ **Pacific SIDS**	Displaces erosion; alters shoreline
MEASURE: PLANTING A MANGROVE OR GRASS	**Applicability:** Erosion; some inundation	**Cost:** Low	✓ **Caribbean SIDS**	✓ **Pacific SIDS**	Slow to implement (grow from saplings); not suitable in high-energy environments
MEASURE: NOURISHING BEACHES	**Applicability:** Erosion and inundation	**Cost:** Low	✓ **Caribbean SIDS**	✓ **Pacific SIDS**	Limited lifetime; only suitable for beach environments; requires sediment source; ongoing maintenance
MEASURE: CREATING SETBACKS	**Applicability:** Erosion and inundation	**Cost:** Variable	✓ **Caribbean SIDS**	✓ **Pacific SIDS**	Difficult in populated or narrow, low-lying islands
MEASURE: CONSERVING REEFS	**Applicability:** Erosion; some inundation	**Cost:** Low	✓ **Caribbean SIDS**	✓ **Pacific SIDS**	Reef sensitivity to climate change and ocean acidification
MEASURE: LOCAL (ISLAND OR ATOLL)	**Applicability:** Avoids impacts	**Cost:** Moderate to high	✓ Caribbean SIDS	✓ Pacific SIDS	Availability of unoccupied higher land; traditional land tenure systems
MEASURE: REGIONAL (COUNTRY)		**Cost:** High	✗ **Caribbean SIDS**	✓ **Pacific SIDS**	Availability of unoccupied higher land; distance and logistics
MEASURE: INTERNATIONAL		**Cost:** High	✗ **Caribbean SIDS**	✓ **Pacific SIDS**	Potential loss of culture, identity, land rights, power

4.4.1

CASE STUDIES

The most popular hard measures applied in **Kiribati** are seawalls, normally built from coral rock, sand bags, and concrete blocks. Of the engineered coastal structures in four South Tarawa islets, 95 percent were seawalls (Duvat, Magnan, and Pouget, 2013). Soft measures, including nourishing beaches, restoring reefs, and planting mangroves, are potential bottom-up or no regrets alternatives to more resource-intensive measures (Sovacool, 2011). Researchers found that restoring or planting mangroves is relatively inexpensive, can reduce erosion by stabilising sediment and modulating wave energy, and can eventually reduce flooding by building land through sediment accretion (Donner and Webber, 2014). In urban South Tarawa, adaptation planners sometimes recommend a combination of hard measures to protect key assets from flooding and land loss, and soft measures to protect against erosion indirectly caused by hard measures (Juillerat, 2012).

Lami Town, which forms part of the Greater Suva area of Fiji, faces risks from flooding associated with heavy rainfall and storm surge, as well as coastal erosion. Based on assessed vulnerabilities, a wide range of possible structural and non-structural measures were identified and adopted (see Figure 4.6). Structural options included constructing seawalls and improving drainage.

Lami is surrounded by large areas of mangrove forest, sea grass, and coral reefs. These natural resources provide a range of ecosystem-based coastal protection. A cost–benefit analysis was carried out to guide adaptation planning by identifying which structural and non-structural options provided the highest returns on investment. Investment costs were compared with the benefits of avoiding damage associated with climate change. EBAs, including replanting mangroves[5] to buffer against flooding and to reduce erosion, were assessed as offering the highest benefit–cost ratio of $19.50 Fiji dollars compared with F$9.00 for structural engineering options, which involved higher capital investment and maintenance costs (ADB, 2013a).

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[5] *EBAs also include tree planting other than mangroves, such as planting pandanus trees near the coastlines of the Marshall Islands.*

FIGURE 4.3

MIX OF ADAPTATION MEASURES USED IN LAMI TOWN, FIJI

Source: UN-Habitat (2014b).

4.4.2

INTEGRATED COASTAL ZONE MANAGEMENT

Fiji is currently promoting ICZM after many protracted efforts to formalise it. In 2003, an ICZM project, funded for two years by the Packard Foundation, focused on the Coral Coast. The intent was to demonstrate to stakeholders how they could work together to make decisions and develop localised coastal management plans. An Integrated Coastal Management Committee was established in 2009 under the Department of Environment and tasked to develop a national coastal plan. On consultation with stakeholders, the committee determined that a more suitable first step would be to develop a framework for a national coastal plan. It wanted to review current coastal conditions in the context of tourism development, coral reef degradation, siltation and erosion, marine resource harvesting, waste management, coastal reclamation and construction, and natural disasters among others. It also wanted to assess the current legal and institutional governing framework to recommend proposals for action and policy toward sustainable coastal resource management for Fiji (Fiji, 2011). One of the main recommendations was to use the framework to build on experiences from bottom-up planning to develop provincial-level ICZM plans that could be consolidated into a national document (Jupiter, Fox, Cakacaka, et al., 2012).

4.4.3

URBAN PLANNING

In the post-independence era and the late 20th century, new village-like settlement forms, such as informal and squatter settlements, accompanied rapid urbanisation. In the contemporary period, informal urbanisation has become a more visible feature of Pacific towns and cities. For example, UN-Habitat (2012) found that, in the Solomon Islands, the urban environment has been transformed through rapid growth of the urban population and expansion of the urban fabric. Furthermore, new urban areas have been informally developed on steep slopes and riverbanks and the local authorities lack the capacity to tackle these problems. Moreover, disaster risk reduction strategies and climate change consideration were absent in urban planning (UN-Habitat, 2012).

4.4.4

ECOSYSTEM-BASED ADAPTATION

Several EBA projects have been implemented in the Pacific, including Fiji's Locally Managed Marine Area Network; Conservation Melanesia, Papua New Guinea; SEPIK Wetlands Management, Papua New Guinea; and Arnavon Community Marine Conservation Area Management, Solomon Islands (UNDP, 2014).

4.5

CONCLUSION

It is noteworthy to highlight that the most desirable adaptive responses are those that augment actions that would be taken even in the absence of climate change because of their contributions to sustainable development (Hay et al., 2003). Where adaptation leads to less pressure on natural resources, improved environmental management, and enhanced social wellbeing of the poor, not only is vulnerability to climate change reduced, but such measures also contribute to sustainable development.

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STRENGTHENING ADAPTATION IN SIDS

STRENGTHENING ADAPTATION AND BUILDING RESILIENCE IN SIDS COASTAL CITIES: REGIONAL RESPONSES, INTERNATIONAL FUNDING, AND DONOR STRATEGIES

Adaptation to climate change is costly. Costs include the funds required to implement the action itself as well as the financial and non-financial costs of "planning, preparing for, facilitating, and implementing adaptation measures, including transaction costs" (UNEP, 2016). Adaptation is a significant financial and resource challenge to SIDS that already face economic, environmental, social, and political constraints such as small size, isolation from world markets, competing development priorities, and relatively greater susceptibility to climate impacts (Nurse et al., 2014). SIDS have called for more access to international adaptation financing (AOSIS, 2015). Moreover, regional bodies and international lending agencies have responded to the challenges facing SIDS in adapting to climate change and building resiliency.

Development funding to SIDS has evolved over the past two decades. According to the OECD Query Wizard for International Development Statistics (QWIDS), the donor community and the private sector directed $55.6 billion in Official Development Assistance (ODA) and private sector flows to Caribbean and Pacific SIDS between 1995 and 2015, nearly doubling average annual aid flows (in current prices). Increases were particularly high in Nauru, whose aid flows increased from $2.5 million in 1995 to $31.3 in 2015, a more than twelvefold increase. Total official and private flows, including ODA, other official flows (OOF), and private flows grew from US$2.6 billion in 1995 to US$5.8 billion in 1995. The Republic of the Marshall Islands experienced a meteoric rise in total official and private flows. Whereas the country received US$138.6 million from 1991-1995, twenty years later flows had increased 46 times to US$6.4 billion across the five-year period from 2011-2015. In the past, these responses have tended to be more sectoral than cross-sectoral or city specific. This section highlights gaps in donor projects, summarises lessons learned, and distils good practices from funded projects.

5.2

CRITIQUE OF REGIONAL RESPONSES TO CLIMATE CHANGE IN THE CARIBBEAN

CARICOM heads of government "agreed to establish a CARICOM Climate Change Task Force to provide guidance to Caribbean climate change negotiators, their Ministers, and the region's political leaders. The Caribbean [Community] Climate Change Centre (CCCCC) along with the CARICOM Secretariat has been tasked with setting up the Task Force and facilitating its work. Heads also reaffirmed the mandate to the CCCCC to develop in partnership with member states, a portfolio of bankable projects eligible for climate financing and to present to the donor community for support." (LCDS, 2014)

Although regional responses have addressed climate change adaptation at the national level among CARICOM member states, they have not focused on urban projects. In the late 1990s, the UNDP Global Environment Facility (GEF) funded the first Caribbean Planning for Adaptation to Climate Change (CPACC) project in CARICOM states (see Table 5.1). Five pilot countries were selected. The project focused on monitoring SLR, establishing database systems, providing an inventory of coastal resources, and using and formulating initial adaptation policies. The main outcome was establishing 18 systems to monitor SLR, as well as data and information networks. The Mainstreaming Adaptation to Climate Change project followed in 2004. It was designed to mainstream climate change adaptation strategies into broader sustainable development agendas for CARICOM SIDS (see Table 5.1).

Over the past 6 years, regional projects within CARICOM have prioritised building institutional capacity, scaling-up lessons about adapting to climate change from the local to the national level, promoting an integrated approach to adaptation as opposed to a sectoral approach, and financing climate change adaptation (see Table 5.1). Given that many of the SLR monitoring systems, including tidal gauges, were not in use, building institutional capacity was a necessary element of subsequent project funding.

A CARICOM regional approach was also adopted to address the critical issue of disaster management. The Caribbean Disaster Emergency Management Agency (CDEMA) has promoted disaster management and resiliency building using a comprehensive approach from pre-disaster to post-disaster recovery and broad stakeholder engagement. The Caribbean Catastrophe Risk Insurance Facility (CCRIF) has focused on risk management and financing disaster management within CARICOM SIDS (see Table 5.1). Currently the CCRIF brings together 17 Caribbean states and territories and up to six Central American countries and the Dominican Republic, offering its members parametric insurance coverage, which provides immediate payouts on acceptance of pre-determined thresholds of a natural hazard event, such as a hurricane or earthquake. Thus, CCRIF member countries are provided fast-disbursing liquidity for relief and recovery efforts in the aftermath of disasters resulting from natural events (Santos and Leitmann, 2015).

5.3

CRITIQUE OF INTERNATIONAL DONOR-FUNDED PROJECTS IN THE CARIBBEAN

The UK Department for International Development (DFID) was one of the first international donors to recognise that a regional approach to climate change adaptation was practical since it resulted in less duplication of effort. The DFID took a leadership role in guiding donor alignment and strengthening governance for climate change resilience. It specifically developed a strategic framework to build sustainable development that would be more resilient to climate change. Fifteen Caribbean states benefited from this shifting paradigm and revised perspective (see Table 5.2).

Based on requests from CARICOM and OECS, projects on policy and technological innovation to adapt to climate change have been funded by other international donors (see Table 5.2). The IDB recognised the importance of data management to monitor climate change and promote adaptation measures and agreed to fund a four-year project to build capacity. In addition, it funded mainstreaming disaster risk reduction and climate change adaptation in national public investment systems. At the local level, the IDB's Emerging and Sustainable Cities (ESC) programme has financed diagnostics to identify the sustainability challenges of Montego Bay, Port of Spain, Haiti's Northern Development Corridor, Nassau, Paramaribo, Bridgetown, Belize City, and pre-investment studies for prioritised interventions and implementing citizen monitoring systems.[6] The European Union promoted sustainable land management and climate change adaptation in OECS countries (see Table 5.2). GIZ also supports integrated climate change adaptation strategies in Grenada.

Problems commonly associated with international aid that are relevant to climate change projects in Caribbean SIDS include:

- Competition for aid
- Limited local human resource capacity (e.g., project management skills)
- Limited stakeholder engagement and project buy-in
- Duplication of effort among donor agencies
- Limited private sector involvement
- Change in political administrations
- Changing money flows and priorities

Together these problems can slow project implementation and compromise the goal of making optimal adaptation decisions.

Additionally, National Adaptation Programmes of Action (NAPAs) have become a principal way of organising adaptation priorities in SIDS, but the majority of plans do not explicitly include urban projects and do not reflect local government perspectives (UN-HABITAT, 2011c). Grenada has recently completed a NAPA which may serve as a pilot for SIDS. NAPAs need to focus on urban adaptation and resilience.

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[6] *Georgetown Guyana will likely be financed in 2017.*

TABLE 5.1

REGIONAL RESPONSES OF CARIBBEAN AGENCIES

Source: Authors based on CCCCC, CDEMA, and CCRIF reports.

	Projects	Policy Category	Objectives
Caribbean Community Climate Change Centre (CCCCC)	Caribbean Planning for Adaptation to Climate Change (CPACC) Project (1997–2001)	Monitoring SLR, developing data and information systems, formulating and implementing adaptation policies	Design and establish a sea level/climate monitoring network; establish databases and information systems; conduct an inventory of coastal resources; formulate and implement initial adaptation policies 18 monitoring systems and data management and information networks installed in 12 countries
	Enhancing Capacity for Adaptation to Climate Change (ECACC) in Commonwealth Caribbean (2007–11)	Enhancing climate change adaptation by establishing national climate change committees and public outreach programmes and conducting Vulnerability and Capacity Assessments (VCA)	Establish National Climate Change Committees in each of the Overseas Territories (Anguilla, British Virgin Islands, Cayman Islands, Montserrat, and Turks and Caicos); develop and implement public education and outreach programmes in each overseas territory; complete VCAs using the methodology developed under the Mainstreaming Adaptation to Climate Change Project; develop climate change policy document for each
	Regional Planning for Climate Compatible Development in the Region (2009–21)	Monitoring and evaluating climate change coping strategies	Develop a strategic approach to cope with climate change by establishing regional and national consultation and cooperation; secure investment to support climate change action plan; propose a monitoring and evaluation system; obtain buy-in from governments and relevant funders across the region
	Caribbean Regional Resilience Development Implementation Plan (2011–16)	Building institutional capacity, scaling-up adaptation programmes across sectors, and promoting climate change adaptation financing	Expand knowledge and capacity through evidenced adaptation initiatives; strengthen institutions for greater climate security; scale-up delivery of adaptation programmes in a range of key vulnerable sectors that are critical for sustained livelihoods; support effective national, regional, and international level climate architecture to deliver climate change/adaptation financing
	SIDS DOCK (2012–16)	Increasing energy efficiency and reducing GHG emissions	Reduce GHG emissions and transform SIDS energy sector to achieve a 25% (2005 baseline) increase in energy efficiency; generate a minimum of 50% of electric power from renewable sources; reduce conventional transportation fuel use by 25%
	Coastal Protection for Climate Change Adaptation in Caribbean SIDS (KfW) (2014–18)	Improving ecosystem services in coastal zones to promote adaptation	Reduce risk of climate change for the SIDS population by improving ecosystem services within coastal areas. The project measures the protection and sustainable management of ecosystems relevant for adaptation
Caribbean Disaster Emergency Management Agency (CDEMA)	Regional Comprehensive Disaster Management (CDM) Strategy (2014-24)	Managing disasters and strengthening resilience	Build and strengthen disaster resilience in the region by employing a comprehensive approach to include all hazards, all phases of the disaster management continuum (mitigation, prevention, preparedness, response, and recovery), and all stakeholders
Caribbean Catastrophe Risk Insurance Facility (CCRIF)	CCRIF Projects (2007- Present)	Mitigating short-term cash flow and financing initial disaster responses	Mitigate short-term cash flow problems small developing economies suffer after major natural disasters and provide rapid payouts to help members finance their initial disaster response and maintain basic government functions after a catastrophic event


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TABLE 5.2

INTERNATIONAL DONOR-FUNDED PROJECTS IN CARIBBEAN SIDS

Source: Authors based on DFID, OECS, J-CCCP, and USAID reports.

Agency	Project Category	Project Objectives
UK Department for International Development (DFID): Building Climate Resilience in the Caribbean (2007–15)	Building climate change resiliency	Develop a strategic framework for attaining sustainable development resilient to climate change for fifteen Caribbean states
Organisation of Eastern Caribbean States (OECS) European Union Funded SLM/ CCA Project (2014–15)	Sustainable land management and climate change adaptation	Address sustainable land management issues and promote climate change adaptation in coastal zones of the OECS
Japan-Caribbean Climate Change Partnership (J-CCCP) (2016–Present)	Implementing innovative climate change technologies using stakeholder engagement	Ensure barriers to implementing climate change technologies are addressed using a participatory approach. Bring together policymakers, experts, and representatives of affected communities to encourage policy innovation incubate and diffuse climate technology
USAID and OECD Rallying the Region to Action on Climate Change (RRACC) project (2015–Present)	Building climate change resiliency	Mitigate coastline erosion; create an integrated watershed rehabilitation and coastal area management initiative; develop community climate change adaptation plans; enhance institutional capacity to mitigate future climate risks

5.3.1 INTER-AMERICAN DEVELOPMENT BANK

The IDB has provided loans or technical cooperation (TC) for numerous projects and programmes to reduce disaster risk, improve coastal management, and coastal flood mitigation infrastructure in the Caribbean. Much of the more than $200 million in projects financed by the IDB between 1994 and 2017[7] relate specifically to housing and sustainable urban development in coastal cities of the Caribbean, such as Belize City (Belize), Bridgetown (Barbados), Nassau (Bahamas), Paramaribo (Suriname), and Port-au-Prince (Haiti). The IDB supports coastal monitoring, LIDAR surveying of coastal areas, and the capacity building of coastal management institutions. Likewise, the IDB's Emerging and Sustainable Cities (ESC) program has financed extensive probabilistic disaster risk analysis to identify vulnerabilities from coastal flooding, storm surge, and different levels of sea level rise, among other factors (Table 5.3).

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[7] *Georgetown Guyana will likely be financed in 2017.*

ADAPTATION IN A TIDAL RIVER CITY: PARAMARIBO

BOX 5.1

The IDB and the Government of Suriname have partnered to increase the sustainability of Paramaribo, Suriname's capital and home to 70 percent of its population. In 2017, the IDB approved a US$20 million loan for the Paramaribo Urban Rehabilitation Programme, which will contribute to the socio-economic revitalisation of the Historic Inner City of Paramaribo, a UNESCO World Heritage Site. The rehabilitation programme builds on the work of the Emerging and Sustainable Cities programme, which in 2016 began developing an action plan for the city with specific proposals to enhance urban sustainability.

Paramaribo is highly vulnerable to inland and coastal flooding because of the high volume of precipitation, poor drainage, and rising sea and river levels. The Historic Inner City is prone to flooding because it is located on low-lying land on the Suriname River, which is vulnerable to tides. Flooding often occurs when the Suriname River is high and is raised further by runoff from impermeable areas. Per the Ministry of Public Works, in 2002, approximately 13 percent of Paramaribo was affected by this combined hazard, causing significant economic damage and deteriorating public health conditions from stagnant water. Vulnerability is expected to increase because of the effects of climate change.

To respond to Paramaribo's climate change challenges, the IDB and the Government of Suriname recently submitted a project proposal to the Adaptation Fund for a US$9.8 million grant. The project seeks to strengthen the adaptive capacity of vulnerable areas of the Historic Inner City, helping Paramaribo cope with observed and anticipated impacts of climate change. The project proposes a series of adaptation measures in the Historic Inner City to support and complement the city's urban rehabilitation objectives. Adaptation measures include: (i) building a floodwall to prevent flooding and erosion along the left bank of the Suriname River, (ii) building green infrastructure (e.g., vegetation and woody material and pole plantings) to complement existing riprap streambank protection, and (iii) upgrading the drainage infrastructure by expanding the capacity of the drainage canals and implementing a maintenance plan. The concept note was endorsed by the Adaptation Fund's Board in March 2017 and submission of the full project proposal is expected in October 2017.

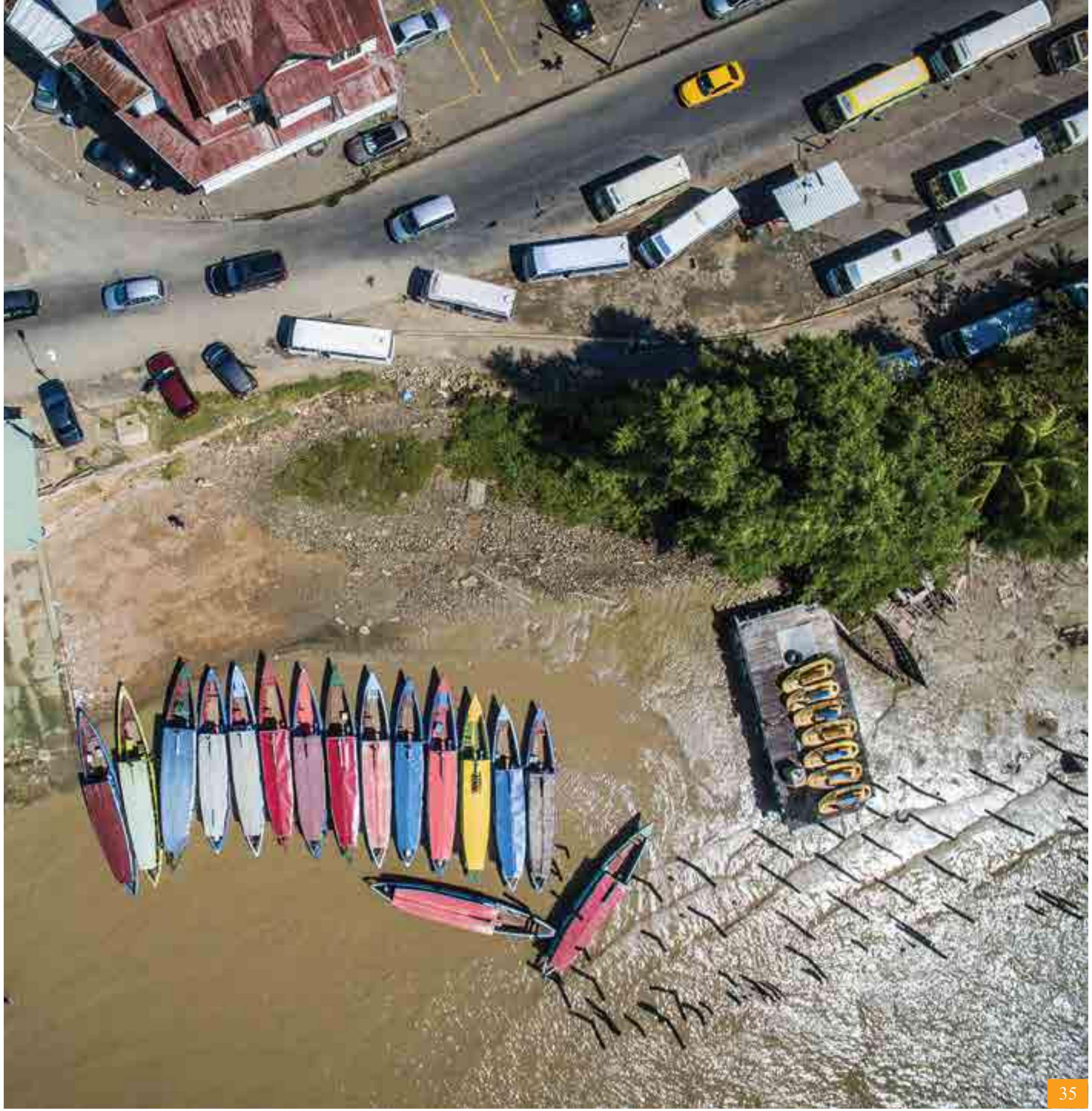
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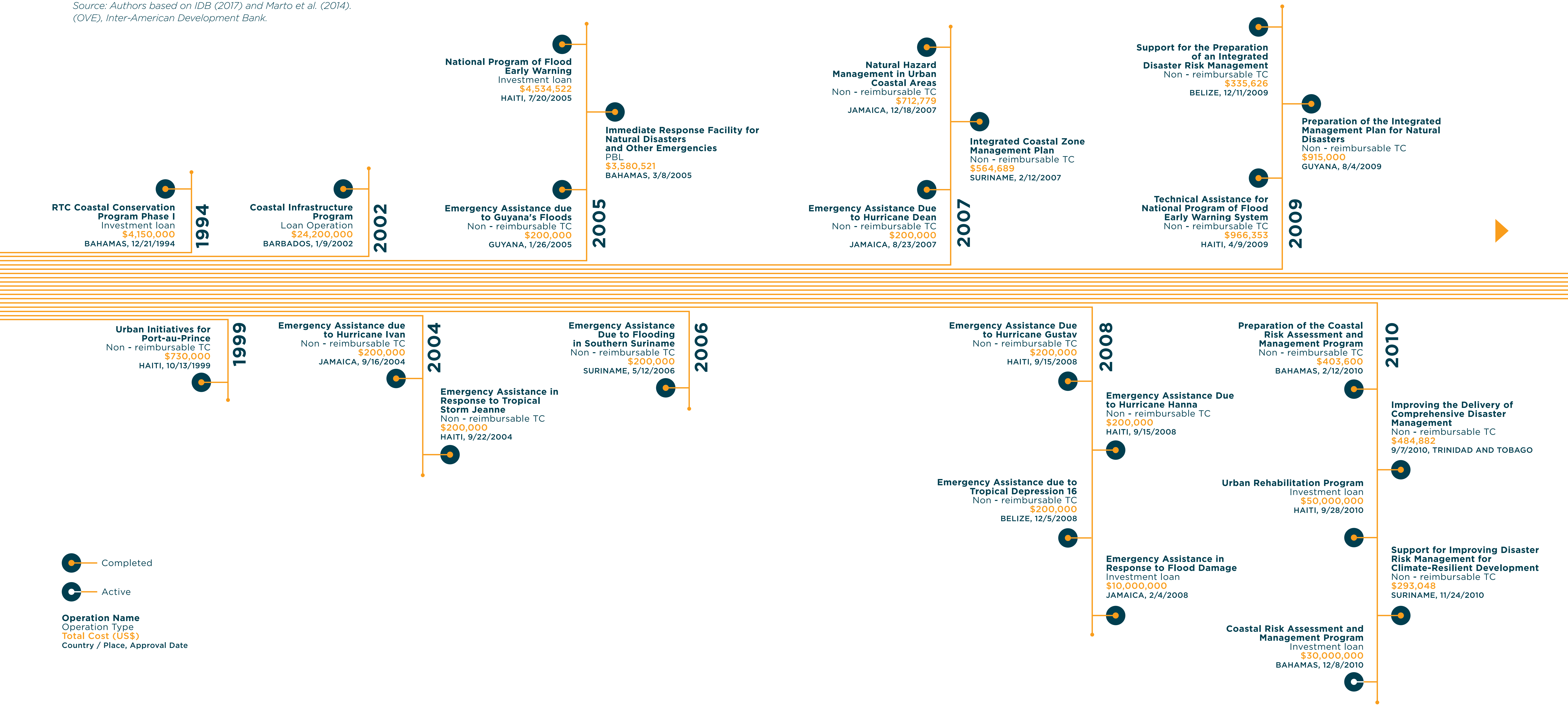
FIGURE 5.1

IDB DISASTER RISK REDUCTION AND COASTAL ZONE MANAGEMENT OPERATIONS AND TECHNICAL COOPERATION IN THE CARIBBEAN, 1994-2017

Source: Authors based on IDB (2017) and Marto et al. (2014). (OVE), Inter-American Development Bank.



1994

RTC Coastal Conservation Program Phase I
Investment loan
$4,150,000
BAHAMAS, 12/21/1994

1999

Urban Initiatives for Port-au-Prince
Non - reimbursable TC
$730,000
HAITI, 10/13/1999

2002

Coastal Infrastructure Program
Loan Operation
$24,200,000
BARBADOS, 1/9/2002

2004

Emergency Assistance due to Hurricane Ivan
Non - reimbursable TC
$200,000
JAMAICA, 9/16/2004

Emergency Assistance in Response to Tropical Storm Jeanne
Non - reimbursable TC
$200,000
HAITI, 9/22/2004

2005

National Program of Flood Early Warning
Investment loan
$4,534,522
HAITI, 7/20/2005

Immediate Response Facility for Natural Disasters and Other Emergencies
PBL
$3,580,521
BAHAMAS, 3/8/2005

Emergency Assistance due to Guyana's Floods
Non - reimbursable TC
$200,000
GUYANA, 1/26/2005

2006

Emergency Assistance Due to Flooding in Southern Suriname
Non - reimbursable TC
$200,000
SURINAME, 5/12/2006

2007

Natural Hazard Management in Urban Coastal Areas
Non - reimbursable TC
$712,779
JAMAICA, 12/18/2007

Integrated Coastal Zone Management Plan
Non - reimbursable TC
$564,689
SURINAME, 2/12/2007

Emergency Assistance Due to Hurricane Dean
Non - reimbursable TC
$200,000
JAMAICA, 8/23/2007

2008

Emergency Assistance Due to Hurricane Gustav
Non - reimbursable TC
$200,000
HAITI, 9/15/2008

Emergency Assistance Due to Hurricane Hanna
Non - reimbursable TC
$200,000
HAITI, 9/15/2008

Emergency Assistance due to Tropical Depression 16
Non - reimbursable TC
$200,000
BELIZE, 12/5/2008

Emergency Assistance in Response to Flood Damage
Investment loan
$10,000,000
JAMAICA, 2/4/2008

2009

Support for the Preparation of an Integrated Disaster Risk Management
Non - reimbursable TC
$335,626
BELIZE, 12/11/2009

Preparation of the Integrated Management Plan for Natural Disasters
Non - reimbursable TC
$915,000
GUYANA, 8/4/2009

Technical Assistance for National Program of Flood Early Warning System
Non - reimbursable TC
$966,353
HAITI, 4/9/2009

2010

Preparation of the Coastal Risk Assessment and Management Program
Non - reimbursable TC
$403,600
BAHAMAS, 2/12/2010

Improving the Delivery of Comprehensive Disaster Management
Non - reimbursable TC
$484,882
9/7/2010, TRINIDAD AND TOBAGO

Urban Rehabilitation Program
Investment loan
$50,000,000
HAITI, 9/28/2010

Support for Improving Disaster Risk Management for Climate-Resilient Development
Non - reimbursable TC
$293,048
SURINAME, 11/24/2010

Coastal Risk Assessment and Management Program
Investment loan
$30,000,000
BAHAMAS, 12/8/2010

● Completed
○ Active

Operation Name
Operation Type
Total Cost (US$)
Country / Place, Approval Date

2011

● **Emergency Assistance: Hurricane Irene**
Non - reimbursable TC
$200,000
BAHAMAS, 9/20/2011

● **Flood Mitigation Infrastructure Program for Belize City**
Investment loan
$10,000,000
BELIZE, 9/7/2011

● **Developing design concepts for climate change resilient buildings**
Non - reimbursable TC
$400,000
JAMAICA, 7/11/2011

2012

● **Piloting the Integration of Coastal Zone Management & CC Adaptation in Tobago**
Non - reimbursable TC
$600,000
TRINIDAD AND TOBAGO, 7/10/2012

● **Capacity Building for Sustainable Management of the Flood Early Warning**
Non - reimbursable TC
$440,000
HAITI, 12/17/2012

2013

● **Feasibility studies for a climate risk- resilient coastal zone management program**
Non - reimbursable TC
$500,000
BAHAMAS, 12/17/2013

● **Preparing for Flood and Alleviation Program in Trinidad and Tobago**
Non - reimbursable TC
$600,000
TRINIDAD AND TOBAGO, 12/12/2013

○ **Montego Bay-Implementing Emerging and Sustainable Cities Initiative Action Plan**
Non - reimbursable TC
$830,000
JAMAICA, 9/11/2013

● **Feasibility Studies for a Risk-Resilient Coastal Zone Management Program**
Non - reimbursable TC
$500,000
TRINIDAD AND TOBAGO, 8/15/2013

○ **Capacity Building Ecosystem Services Valuation ICZM Best Practice Dissemination**
Non - reimbursable TC
$600,000
BAHAMAS, 7/29/2013

○ **Haiti's Northern Development Corridor - Implementation of ICES**
Non - reimbursable TC
$1,000,000
HAITI, 5/20/2013

● **Emergency Assistance due to Hurricane Sandy**
Non - reimbursable TC
$200,000
BAHAMAS, 1/10/2013

2014

○ **Implementation of the ESCI in the City of Bridgetown, Barbados**
Non - reimbursable TC
$100,000
BAHAMAS, 7/21/2014

○ **Implementation of the ESCI in the City of Bridgetown, Barbados**
Non - reimbursable TC
$900,000
BAHAMAS, 7/21/2014

○ **Mainstreaming Biodiversity, Ecosystem Services and Coastal Resilience in Tourism**
Non - reimbursable TC
$242,499
BELIZE, 11/7/2014

○ **Sustainable Coastal Tourism Program**
Investment loan
$36,000,000
HAITI, 12/11/2014

2015

○ **Knowledge and Innovation: Disaster and Climate-Resilient Coastal Zone**
Non - reimbursable TC
$680,000
REGIONAL CARIBBEAN PROGRAMS, 11/30/2015

○ **Implementation of the Emerging and Sustainable Cities Initiative in Paramaribo**
Non - reimbursable TC
$1,100,000
SURINAME, 9/21/2015

○ **Implementation of the Emerging and Sustainable Cities Initiative in Belize City**
Non - reimbursable TC
$359,448
BAHAMAS, 8/12/2015

○ **Implementation of the Emerging and Sustainable Cities Initiative in Belize City**
Non - reimbursable TC
$740,552
BAHAMAS, 8/12/2015

2016

○ **Natural capital study for improved coastal resilience in the Caribbean**
Non - reimbursable TC
$300,000
5/20/2016
REGIONAL CARIBBEAN PROGRAMS

2017

○ **Paramaribo Urban Rehabilitation Program**
Investment loan
$20,000,000
SURINAME, 1/25/2017

● Completed
○ Active

Operation Name
Operation Type
Total Cost (US$)
Country / Place, Approval Date

5.3.2

WORLD BANK-FUNDED PROJECTS IN THE CARIBBEAN AND PACIFIC

The World Bank has actively supported projects to adapt to climate change, reduce disaster risk, and build resiliency in the Caribbean and the Pacific. Some of the projects in the Caribbean commenced in the late 1990s. In the past three years, the World Bank has focused on reducing disaster vulnerability and strengthening resiliency to climate change in the Pacific. One of the earliest adaptation projects funded by the World Bank in the Pacific was the project in Kiribati in 2003.

TABLE 5.3

WORLD BANK CLIMATE CHANGE ADAPTATION PROJECTS IN THE CARIBBEAN AND PACIFIC

Source: Authors based on information provided in World Bank (2017).

CARIBBEAN

2017

- ● St. Vincent and the Grenadines: Regional Disaster Vulnerability Reduction Project

  US$ 6,810,000

2016

- ● Jamaica Disaster Vulnerability Reduction Project

  US$ 30,000,000

- ● St. Lucia: Disaster Vulnerability Reduction Project (Additional Finance)

  US$ 8,090,000

2015

- ● Jamaica: Improving Climate Data and Information Management

  US$ 7,500,000

- ● Guyana: Cunha Canal Rehabilitation

  US$ 3,270,000

- ● Caribbean Climate Innovation Centre

  US$ 3,000,000

2014

- ● Guyana: Flood Risk Management in East Demarara

  US$ 11,890,000

- ● Saint Vincent and the Grenadines: Regional Disaster Vulnerability Reduction Project (Additional Finance)

  US$ 40,600,000

- ● Dominica: Third Phase Disaster Vulnerability Reduction

  US$ 39,500,000

2011

- ● Grenada and St. Vincent and the Grenadines: Regional Disaster Vulnerability Reduction Project

  US$ 53,120,000

2007

- ○ Guyana - Conservancy Adaptation Project

  US$ 5,000,000

2006

- ○ CARIB-GEF: Implementation of Adaptation Measures in Coastal Zones

  US$ 5,470,000

2004

- ○ St. Lucia: Disaster Management Project II

  US$ 8,900,000

2003

- ○ Mainstreaming Adaptation to Climate Change Project

  US$ 10,950,000

1998

- ○ St. Kitts and Nevis: OECS Emergency Recovery & Disaster Management Project

  US$ 57,000,000

1997

- ○ Planning for Adaptation to Global Climate Change Project (GEF)

  US$ 6,200,000

PACIFIC

2016

- ● Vanuatu: Infrastructure Reconstruction and Improvement Project

  US$ 50,000,000

2015

- ● Tonga: Pacific Resilience Program

  US$ 12,180,000

- ● Pacific Islands: Pacific Resilience Program

  US$ 9,470,000

2014

- ● Tonga: Cyclone Ian Reconstruction and Climate Resilience Project

  US$ 15,890,000

- ● Solomon Islands: Community Resilience to Climate and Disaster Risk Project

  US$ 9,130,000

- ● Solomon Islands: Pacific Islands Regional Oceanscape Program

  US$ 9,750,000

2013

- ● Samoa: Enhancing the Climate Resilience of Coastal Resources and Communities

  US$ 14,600,000

2012

- ● Vanuatu: Mainstreaming Disaster Risk Reduction

  US$ 2,730,000

- ● Vanuatu: Increasing Resilience to Climate Change and Natural Hazards

  US$ 11,520,000

- ● Samoa: Enhancing the Climate Resilience of the West Coast Road

  US$ 17,020,000

- ● Solomon Islands: Increasing Resilience to Climate Change and Natural Hazards

  US$ 2,730,000

- ○ Papua New Guinea: Settlement Upgrading Programme

  US$ 350,000

2011

- ○ Papua New Guinea: Disaster Risk Management and Climate Change Adaptation Program

  US$ 1,870,000

- ○ Papua New Guinea: Building a More Disaster and Climate Resilient Transport Sector

  US$ 2,930,000

- ○ Samoa Pilot Programme for Climate Resilience

  US$ 500,000

- ○ Samoa City: Development Strategy Programme

  US$ 240,000

- ● Kiribati: Adaptation Phase III (LDCF)

  US$ 10,800,000

2003

- ○ Kiribati: Adaptation Project

  US$ 3,730,000

● **Active**
○ **Closed**

5.4

CRITIQUE OF DONOR-SPONSORED PACIFIC SIDS CLIMATE CHANGE ADAPTATION PROJECTS

Within the Pacific region there are several climate change projects, as summarised in Table 5.5. Most project funding was allocated for adaptation in the water sector. The main countries offering bilateral assistance to the Pacific region were Australia, Japan, and New Zealand. Multilateral donor organisations were the European Union, the Asian Development Bank (ADB), the World Bank, UNDP GEF, the Australian Agency for International Development (AUSAid), Japan International Cooperation Agency (JICA), USAID, and Deutsche Gesellschaft für International Zusammenarbeit (GIZ).

The ADB (2010) reported several obstacles to the success of climate change adaptation projects in many Pacific SIDS, including:

- Weak capacity and engagement of various national institutions
- Limited involvement of private industry
- Large financing needs for relevant technology
- The general inability of Pacific countries to gain access to funds

These constraints have all contributed to a disconnect between country aspirations and the delivery of climate-related programmes on the ground (ADB, 2010).

Earlier assessments of projects in Pacific SIDS found that the countries generally lacked resources or technical expertise and therefore heavily relied on international aid for development and adaptation (Barnett and Adger, 2003). Pacific SIDS projects are similar to those in the Caribbean. They address policy themes such as monitoring SLR, water security, public participation in project design and implementation, reducing disaster risk, and EBA.

TABLE 5.4

INTERNATIONAL DONOR-FUNDED PROJECTS IN PACIFIC SIDS

Source: Authors based on reports from avvv, PACC, SPC, AUSAid, and GIZ.

Agency	Projects	Project Category	
AUSAid	Pacific Sea Level Monitoring (PSLM) (1996–Onwards)	Monitor SLR	• Generate accurate record of variance in long-term sea level for 14 Pacific countries. • Generate information on processes, scale, and implications of SLR and variability of extreme events on South Pacific communities. • Make sea-level data more readily available and usable to support management of coastal infrastructure and industries. This project is led by the Australian Government Bureau of Meteorology.
	Vanuatu Roads for Development (2012-2017)	Climate proofing infrastructure	• The projects builds climate change considerations into road construction, such as investing in slope stabilisation, hard paving, and larger lateral and cross-drains to allow water to drain.
	Climate Finance Readiness for the Pacific (2016-2018)	Improve use of climate finance by Pacific recipient countries	• Seeks to strengthen public financial management systems of Pacific governments to better manage and disburse, climate finance they receive.
Pacific Adaptation to Climate Change Programme (PACC)	Tuvalu: New communal water reserves (2010–12)	Use water resource management techniques to reduce effects of water scarcity	• Improve communal water infrastructure to assist population to better cope with droughts and raise awareness of climate change and water resources.
	Samoa: Community-based integrated coastal protection (2011–12)	Use public participation to increase resiliency by introducing specific hard and soft adaptation techniques	• Implement community-based integrated coastal protection model to increase resilience of coastal communities and infrastructure by re-vegetating coastal areas, building protection structures, and building community awareness, consultations, and engagement.
	Enhancing Resilience of Coastal Infrastructure and Community Assets (2011–13)	Use public participation and awareness programmes to develop coastal management adaptation techniques specific to the area	• Work with local communities to develop appropriate coastal zone management approaches to adapt to flooding and coastal erosion.
	Mangaia Harbour, Cook Islands: Climate proof harbour and protect island coastline (2011–14)	Use hard coastal engineering to upgrade damaged harbour and increase coastal resiliency and adaptation	• Develop stronger and safer harbour that can withstand current and future climate-related threats. • Help develop integrated coastal management policy framework and implementation plan for Mangaia coastline.
	Nauru: Water resources management (2012–13)	Use integrated water resource management principles to increase adaptability of population against drought and water scarcity	• Develop comprehensive water supply system for Nauru by collecting rainwater, seawater, and groundwater.

TABLE 5.4
CONTINUATION

Source: Authors based on reports from avvv, PACC, SPC, AUSAid, and GIZ.

Agency	Projects	Project Category	Project Objectives
Secretariat of the Pacific Community (SPC)	National Adaptation Programmes of Action (NAPA) (2008–Present)	Monitor and assess urgent needs of an area and finance hard and soft adaptation systems to effectively and urgently address immediate adaptation needs	• Identify priority activities that respond to urgent and immediate needs to adapt to climate change – those for which further delay would increase vulnerability and/or costs at a later stage. (Pacific: Kiribati, Samoa, Solomon Islands, Tuvalu, and Vanuatu)
	Joint National Action Plans (2010–16)	Manage disaster risk and adapt to climate change for sustainable development	• Merge climate change adaptation and disaster risk management sectors to address risks to key development sectors in a coordinated fashion throughout the Pacific Islands.
	Climate Change Engagement Strategy for SPC (2011–15)	Address climate change challenges by identifying risks and providing relevant climate change knowledge, technical assistance, and resources to inform policy and operational decisions.	• Provide overarching framework for SPC's climate change work, set organisational objectives, and identify key results against which progress can be monitored.
	Global Climate Change Alliance: Pacific Small Island States (2011–16)	Finance hard and soft adaptation methods to increase resilience.	• Support the governments of the Cook Islands, Kiribati, Marshall Islands, Micronesia, Nauru, Niue, Palau, Tonga, Tuvalu, and regional bodies' efforts in tackling the adverse effects of climate change at a regional and national level.
United States Agency for International Development (USAID)	Coastal Community Adaptation Project (C-CAP) (2012–16)	Increase public participation, map and analyse risk, build hard and soft adaptations, and build capacity to increase resilience and reduce the effects of climate change.	• Support local-level climate change interventions in 12 Pacific Island countries: • Rehabilitate and construct new small-scale community infrastructure to structurally withstand climate change impacts and increase community resilience. • Build capacity for community engagement for disaster prevention and preparedness. • Adopt new strategies and integrate climate resilient policies and practices into long-term land-use plans and building standards.
Deutsche Gesellschaft für International Zusammenarbeit (GIZ)	Coping with Climate Change in the Pacific Island Region (2009–18)	Strengthen regional advisory and management capacity. Created national action plan to assist in climate change adaptation and disaster risk management. Improve public awareness to increase adaptive capacity and resilience in Pacific countries.	• Enhance skills and capabilities of local population, national governmental authorities, and regional organisations to reduce effects of climate change and combat its causes. • Prepare National Action Plan for Climate Change Adaptation and Disaster Risk Management.

Utirik Atoll, Republic of the Marshall Islands
Photo by NASA

Image: Archive NASA.– Utirik Atoll - 2014-02-09 - Landsat 8 - 15m.png. Wikimedia Commons

NASA/USGS Landsat satellite image GeoTIFF archive

5.4.1

PACIFIC REGION CLIMATE INVESTMENT FUNDS

The Pacific Region Climate Investment Funds have provided financial and technical support to Pacific SIDS. Projects include the Climate Resilience Sector Project, implementing the Strategic Programme for Climate Resilience, the Pacific Resilience Programme, and the Pilot Programme for Climate Resilience (PPCR).

Papua New Guinea, Samoa, and Tonga have taken the lead in designing a strategic regional programme that builds on existing cooperative frameworks to address climate change risks. These countries will use US$75 million in grant financing from the PPCR for investments designed to mainstream climate change adaptation and disaster risk reduction into national, sectoral, and local development planning and action. In addition to providing direct financial support for transformational climate resilience projects, the Pacific region's PPCR financing is intended to support Papua New Guinea, Samoa, and Tonga, as well as non-PPCR pilot countries in the region, in developing local and national capacities for climate resilience planning, coordination, and action. Samoa is using US$15 million in grant funding under the Pacific Region Climate Investment Funds to develop its capacity to manage the coastal zone.

In recent years, better collaboration among donor agencies has produced improvements in project outcomes. The Pacific Small Island States Evaluation Report (PREA, 2016) noted that there was no duplication with other EU-funded projects, but that instances of duplication may occur in the future where other donors are proposing projects that have the potential to reduce the impact of the Global Climate Change Alliance interventions. An example highlighted in the report was the medium- to long-term benefits of refurbishing the Koska well and harvesting rainwater in Anguar, Palau, which may be reduced by the proposed project to install a US$3 million water treatment plant funded by the United Arab Emirates.

5.5

CRITIQUE OF DONOR FINANCING FOR CLIMATE CHANGE ADAPTATION IN SIDS CITIES

As discussed above, international development financing is a key source of support for climate change adaptation in SIDS. However, many vulnerable cities and municipalities in developing countries such as SIDS are poorly positioned to access available funding (ICLEI, 2010; Paulais and Pigey, 2010) for their often very large deficits in risk-reducing infrastructure and services. The IPCC's Fifth Assessment Report noted that, in some local governments, international programmes offer the main source of institutional and financial support for mitigation and adaptation work at the local level, but this can raise the danger of a donor-driven model, where the funding agency's agenda does not coincide with local priorities. Additionally, experience shows that without strong and lasting local ownership, programmes are unsustainable once support is withdrawn (Hedger, 2011; OECD, 2012).

More international funding for adaptation and mitigation is being committed, largely as official development assistance, and governments are broadly on track delivering on their international promises, such as the Cancun Agreements, to scale up international climate finance (Buchner, Falconer, Hervé-Mignucci, et al., 2012; Clapp, Ellis, Benn, et al., 2012). The members of the OECD Development Assistance Committee reported that the agency committed approximately US$2 billion in total adaptation financing to SIDS across all sectors between 2010 and 2014. This was roughly 6 percent of the total committed to all developing countries (Robinson and Dornan, 2016). Ten SIDS received 73 percent of total adaptation financing between 2010 and 2014. Furthermore, the allocation of funding to SIDS was highly skewed, with Cabo Verde, Dominican Republic, Haiti, Guyana, and Timor-Leste receiving the highest commitments (Robinson and Dorman, 2016). However, Caribbean SIDS received the most funding (41 percent) in contrast to the Pacific (36 percent) and the Africa, Indian Ocean, Mediterranean, and South China Sea (AIMS) SIDS (23 percent) for 2010 to 2014. The top five donors to SIDS were Australia, France, the European Union, Japan, and Norway. Australia committed 48 percent of donor funding to the Pacific SIDS.

Despite adaptation financing to SIDS, it is noteworthy that evidence is limited on sound institutional arrangements to make this support available to SIDS urban governments. The "Special Report on Managing the Risks of Extreme Events and Disasters to Advance Climate Change Adaptation" calls for arrangements that will allow adaptive urban management systems to evolve with changing social and environmental dynamics (Field, Barros, Stocker, et al., 2012), but international channels for development finance have yet to adjust to this call to action.

A review of data on financing revealed that not much funding is provided for SIDS cities. Recent data suggest that a small share of total flows of climate-related official development assistance targets adaptation (UNEP, 2011; OECD, 2012), and some of this is supporting urban adaptation (e.g., see OECD, 2013; World Bank, 2013a, 2016). The OECD estimated bilateral official development assistance commitments targeting climate change to be US$11 billion to US$20 billion per year on average in 2010 and 2011 for both adaptation and mitigation. Of this, roughly 20 to 40 percent targeted adaptation (OECD, 2013). One in-depth assessment of five major donors, covering concessional and non-concessional financing, estimated adaptation to be 30 percent of their climate change portfolio, mostly targeted to water and sanitation (about 75 percent) (UNEP, 2011). The rest were for other relevant sectors (i.e., transport, policy loans, and disaster risk reduction), but with energy and health largely overlooked (UNEP, 2011; Atteridge, Siebert, Klein, et al., 2009). Despite an increasing focus on climate change, many bilateral agencies have historically had very limited engagement with urban initiatives (Mitlin and Satterthwaite, 2013). Some authors also note the difficulty in distinguishing adaptation from development finance, which limits the accuracy of such estimates (Tirpak, Ronquillo-Ballesteros, Stasio, et al., 2010; Buchner et al., 2012).

5.6

DONOR-FUNDED CITY RESILIENCY PROJECTS IN CARIBBEAN SIDS

Gaps in funding city adaptation to climate change have been closed in recent years by development financing institutions such as the World Bank, the IDB, and the CDB, and development agencies such as the United Nations Environment Programme (UNEP), UN-Habitat, the Commonwealth Secretariat, the European Union, and AUSAid. Furthermore, many of the projects to help Caribbean cities adapt and build resilience have been funded over the past five years (see Table 5.6). These projects have been implemented either fully or partially in capital cities: Castries (Saint Lucia), Kingston (Jamaica), Port of Spain (Trinidad), Georgetown (Guyana), Bridgetown (Barbados), as well as cities in Antigua and Barbuda, Dominica, and St. Kitts and Nevis (see Table 5.6). The thematic areas covered by donors are summarised in Table 5.6.

TABLE 5.5

SUMMARY OF CARIBBEAN DONOR PROJECTS BY THEMATIC AREA

Source: Various

🟩 ACCOMMODATION
🟥 PROTECTION
🟧 CLIMATE CHANGE FINANCING
🟦 RESILIENCE
🟫 RETREAT
⬛ MITIGATION

KINGSTON, JAMAICA	Building Climate Resilience of Urban Systems Through EBA (UNEP GEF Project, 2015)	🟩 **EBA**
BRIDGETOWN, BARBADOS	he Coastal Conservation Feasibility and Pre-investment Study (IDB, 1991)	🟩 **Conserve coastline**
BELIZE CITY, BELIZE	Flood Mitigation Infrastructure Program for Belize City (IDB, 2011-2017)	🟩 **Reduce vulnerability to flooding events**
CASTRIES, SAINT LUCIA	Climate Change Adaptation Planning (World Bank, 2014)	🟩 **Build capacity for city planning**
BRIDGETOWN, BARBADOS	Coastal Risk Assessment and Management Programme (IDB, 2011–present)	🟩 **Reduce coastal hazard; enforce building code**
BRIDGETOWN, BARBADOS	Coastal Infrastructure Programme (CIP) (IDB, 2002–09)	🟥 **Integrated watershed management, ICZM, sustainability of coastal infrastructure** 🟩 **Integrated watershed management, ICZM, institutional development for coastal management** 🟫 **Use coastal setbacks for new buildings and manage realignment**
GEORGETOWN, GUYANA	Guyana Conservancy Adaptation Project (World Bank, 2007)	🟥 **Improve drainage**
KINGSTON, JAMAICA	The Palisadoes Peninsula Shoreline Protection and Rehabilitation Project (Government of Jamaica, 2013)	🟥 **Build coastal infrastructure**
GEORGETOWN, GUYANA	Sea and River Defence Project (CDB, 2013)	🟥 **Improve drainage** 🟦 **Train in geographic information systems and public education**
GEORGETOWN, GUYANA	Flood Risk Management Project (World Bank, 2014)	🟥 **Improve drainage** 🟦 **Build institutional capacity to reduce flood risk; project management and implementation support**
CITIES OF ANTIGUA AND BARBUDA, DOMINICA, GUYANA, JAMAICA, ST. KITTS AND NEVIS:	Commonwealth Climate Finance Access Hub (Australian Government and Commonwealth Secretariat, 2015–20)	🟧 **Climate change financing**
KINGSTON, JAMAICA	Promoting Energy and Renewable Energy in Buildings (UNEP GEF Project, 2010)	⬛ **Increase energy efficiency and reduce GHG emission**

Among the projects funded by UN-Habitat[8] and the World Bank are those that address capacity building in city planning, including implementing building codes, developing data platforms to monitor climate change and assess the risk for cities, financing insurance and climate change adaptation, and strengthening risk governance at the city level.

UNEP projects have supported soft approaches to adapting to climate change in coastal cities, including EBA, energy efficiency, and mitigation, such as reducing GHG emissions.

The IDB has funded a mix of hard engineering (e.g., coastal infrastructure projects to reduce flood risk and coastal erosion) and soft approaches (e.g., operationalising building codes, improving public awareness, and training stakeholders) to help cities adapt to climate change and build resiliency. By targeting multiple objectives, the IDB has managed to maximise the co-benefits of such interventions.

Most international banks, such as the World Bank and the IDB, have financed infrastructure projects on the request of governments such as Barbados, Trinidad and Tobago, and Guyana. Examples include the coastal defence projects in Bridgetown, drainage projects in Port of Spain, and sea and river defences in Georgetown.

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[8] *For example, UN-Habitat's Cities and Climate Change Initiative (CCCI) has supported climate change vulnerability assessments in Apia (Samoa), Honiara (Solomon Islands), Lami Town (Fiji), and Port Moresby (Papua New Guinea).*

5.6.1

PROJECT DETAILS

A sample of climate change adaptation projects in 12 Caribbean cities is presented below.

1

Castries, Saint Lucia: Climate Change Adaptation Planning (World Bank, 2014)

Project objectives:

- Devolve risk management and planning capacity to the city level
- Build capacity within national and city government institutions engaged in climate change planning and risk management
- Create mechanisms to collect data, store and disseminate and/or improve climate monitoring, risk planning, and information sharing
- Improve insurance mechanisms and climate financing for long-term recovery and to build resilience against floods and landslides
- Integrate risk management practices on a cross-scale basis
- Shift from disaster management to long-term risk reduction and climate change adaptation to ensure a proactive and forward-looking system of risk governance

2

Kingston, Jamaica: Promoting Energy and Renewable Energy in Buildings (UNEP GEF Project 2010–16)
Project cost: US$7,091,000

Project goals:

- Increase energy efficiency
- Reduce CO^{2} emissions
- Increase the resilience of buildings to the anticipated impacts of climate change
- Reduce dependency on imported oil
- Reduce financial outflows
- Increase competitiveness as a result of improved building practices

Project objectives:

- Develop highly energy efficient solutions to make urban households more self-sufficient
- Use smart building concepts to retrofit buildings
- Incorporate renewable energy technologies to enable development of zero net energy buildings in urban areas. Construct a demonstration building to show stakeholders the feasibility and environmental benefits of using this innovative and adaptive solution to climate change
- Develop a national policy and regulatory framework to retrofit all existing buildings and amend the draft building code to mandate new standards across Jamaica
- Disseminate information using education and training programmes and media campaigns that could be scaled-up to the Caribbean and other tropical regions

The main executing partner was The University of the West Indies. Technical and advisory support was provided by ministries, regulatory authorities, research institutions, professional associations for engineers, architects and building contractors, and donors such as the IDB. Moreover, the project was expected to establish links with the World Bank, IDB, and UNDP portfolio of building-related projects

3

Kingston, Jamaica: The Palisadoes Peninsula Shoreline Protection and Rehabilitation Project (Government of Jamaica, 2013)
Project cost: US$1,563,610

Project objectives:

- Erect rock revetment walls along 2.65 kilometres of shoreline
- Elevate road to 2.4–3.2 metres (from 0.6–1.0 metre) above sea level
- Place additional drainage facilities along the roadway for the Caribbean Sea side of the island, including 14 drop inlets and culverts and 4,700 metres of swales
- Construct a 10-metre wide boardwalk on the harbour side of the Peninsula
- Design rehabilitative and protective works along the Peninsula for a 100-year return period

4

Kingston, Jamaica: Building Climate Resilience of Urban Systems Through EBA (UNEP GEF, 2015)
Project cost: US$6,000,000

Project objectives:

- Identify indicators to measure socio-economic needs (e.g., reduced flooding and related losses, increased availability of potable water, reduced thermal load) and role of adaptation measures to meet needs
- Increase the climate change resilience of vulnerable urban communities in Kingston
- Respond to limitations highlighted in the country's urban sector by developing new policies or adapting to existing or new strategies that will promote the concept of a Climate Smart Urban Area
- Use innovative participatory methodologies to integrate climate change into urban systems

5

Belize City, Belize: Flood Mitigation Infrastructure Program for Belize City (IDB, 2011-2017).
Project cost: US$10,000,000

Project objectives:

- To support the Government of Belize in the rehabilitation, improvement and protection of the Belize City's drainage and urban road networks aiming at reducing Belize City's vulnerability to flooding events
- Finance maintenance works (cleaning, disposal of waste material and lining, among others) of the existing concrete-lined and earthen canals, and secondary drains (feeder drains) in order to improve the performance of the existing canal system
- Support institutional strengthening of the Department of the Environment of Belize
- Finance studies aimed at increasing the planning capacity for future investments and risk reduction strategies, including a natural disaster risk assessment study of Belize City

6

Bridgetown, Barbados: The Coastal Conservation Feasibility and Pre-investment Study (IDB, 1991)

Project objectives:

- Assess causes of coastal degradation on the west and south coasts of Barbados, where most human settlements, infrastructure, and tourism (the economic mainstay) are concentrated
- Make recommendations for remedial strategies

Project outcome:

- Coastal Conservation Project Unit established

39

7

Bridgetown, Barbados: Coastal Infrastructure Programme (IDB, 2002)

Project objectives:

- Link development decisions in watersheds to associated coastal and marine areas
- Broaden scope of Coastal Zone Management Unit and draft Coastal Zone Management Plan

Project outcome:

- Several technical issues were examined such as inter-institutional coordination and sustainability of the coastal stabilisation structures

8

Bridgetown, Barbados: Coastal Risk Assessment and Management Programme (IDB, 2011)
Project cost: US$30,000,000

Project objectives:

- Build resilience to coastal hazards by improving conservation and risk management
- Accelerate enactment of the building code
- Make enforcement of the building code an integral part of any short-to medium-term implementation plan for hazard and risk assessments

9

Guyana Conservancy Adaptation Project (World Bank, 2007)
Project cost: US$5,000,000

Project objective:

- Reduce the vulnerability of catastrophic flooding in the low-lying coastal area that is threatened by SLR resulting from climate change

10

Georgetown, Guyana: Sea and River Defence Project (CDB, 2013)
Project cost: US$25,000,000

Project objectives:

- Provide for reconstructing and improving approximately 5.4 kilometres of sea and river defences in eight critical areas
- Build capacity using activities such as establishing a shoreline change monitoring system, enhancing the Shore Zone Monitoring System (a Geographic Information System managed by the Works Services Group) and training its staff
- Implement community awareness and education programme to increase community awareness of disaster risk and human actions and activities that could compromise coastal protection, and to influence positive behavioural change

11

Georgetown, Guyana: Flood Risk Management Project (World Bank, 2014, 2016)
Project cost: US$12,000,000

Project objectives:

- Build hard engineering to reduce flooding risks
- Strengthen institutions to reduce flood risk
- Provide project management and implementation support

12

Cities of Antigua and Barbuda, Dominica, Guyana, Jamaica, St. Kitts and Nevis: Commonwealth Climate Finance Access Hub (Australian Government and Commonwealth Secretariat, 2015–20)

Project objective:

- Assist governments in dealing with the ravaging effects of climate change by accessing funding from a global fund target of US$100 billion a year by 2020

COASTAL PROGRAMMES OF THE GOVERNMENT OF BARBADOS AND THE IDB

BOX 5.2

For more than 30 years, the IDB has partnered with the Government of Barbados to support progress in coastal zone management (CZM). The IDB has invested more than US$58 million (through loans and TCs) to support the enactment of key legislation and policies, strengthen local capacities, foster exchanges with international experts, and sustain engineering projects to protect the shoreline. A first loan in 1994 (RTC Coastal Conservation Program Phase I, BA-0014) supported work towards the establishment of the Barbados Coastal Zone Management Unit (CZMU) in 1996, passage of the CZM Act of 1998, and a draft National CZM Plan.

Approved in 2010, the Coastal Risk Assessment and Management Program (BA-L1014), expanded the institutional strengthening of the CZMU and supported the construction of shoreline stabilization works. For instance, the Bank supported the Holetown beach improvement project and the Rockley to Coconut Court waterfront improvement project, which created 4.5 kilometres of continuous safe beach access and increased beach volume by 16,000 square metres. Physical investments are ongoing, with offshore breakwaters, groynes, beach nourishment, and walkways extending over 1.5 kilometres along the west coast between Holetown and Heron Bay. The Richard Haynes Boardwalk boosted local economic activities, increased property values (in particular property affected by storm surge and erosion), boosted restaurant revenues, and increased access to the coast by around 16,000 person-days per year. The first rigorous impact evaluation of a shoreline stabilisation programme in Barbados indicated an approximate increase of 9 percent in GDP in the first 3 years after the intervention (Corral et al., 2016).

Altogether, the effectiveness of IDB operations was enhanced by a combination of institutional capacity, ownership, and resources devoted to coastal research. As one of the first national ICZM programmes for a developing country, this project has become a reference for similar initiatives in the Caribbean. Barbados has been called on to provide technical assistance to other countries that consider its model a best practice. As a result, the Bank has extended its support to The Bahamas, Dominican Republic, Haiti, Suriname, and Trinidad and Tobago.

The success of the Barbados' CZM experience is especially praiseworthy given how it transcended several challenges including: (i) the high degree of technical complexity of designing shoreline infrastructures which takes into account sediment transport, hydrology, and wave action; (ii) the specialised procurement required to sustain these investments, in particular the technical specifications for construction materials; (iii) the lengthy process involved in obtaining construction permits in coastal areas; and (iv) the high turnover in coastal property ownership, which increased the number of negotiations with new owners. The CZM Unit has continued to address disaster risk and climate change adaptation demands, maintain high-quality risk information on coastal areas, and undertake climate modelling and appropriate coastal monitoring.

Source: Marto et al. (2014).

40

41

42

43

5.7

CRITIQUE OF DONOR-FUNDED CITY RESILIENCY PROJECTS IN PACIFIC SIDS

A report prepared by the ADB (ADB, 2013) entitled “Sustainable Urban Development in the Pacific: Moving from Risk to Resilience” noted that, in urban development projects where development plans or spatial frameworks were developed as a strategy, the main constraints were as follows:

- Where plans existed, they were rigid, top-down, and developed without active participation of stakeholders.
- Plans lacked community and political buy-in.
- Urban managers lacked the capacity to implement the plan. Budgetary resources were limited.
- Institutional arrangements for resiliency were weak.

An example of this was found in Apia, the capital of Samoa, where major floods occurred. The ADB (2013b) noted that existing policies and regulations were rarely enforced and/or monitored. Moreover, comprehensive flood management guidelines drafted in 2008 had not been accepted or implemented.

The report also noted that in many Pacific SIDS there were other constraints to adaptation and resiliency, including (ADB, 2013b):

- The absence of a single government agency to promote resilience to climate change.
- A patchwork of laws and regulations covering the urban sector, with responsibility fragmented across agencies.
- Limited interaction between urban authorities, disaster management offices, and climate change agencies to share information and data on natural hazard and climate change risks and the impact on urban management, such as land use or infrastructure design.
- A lack of human and financial resources.
- A lack of town planners and civil engineers in the Pacific Region.

5.7.1

PROJECT DETAILS

A sample of projects in Pacific SIDS and funded by donor agencies is presented below. Table 5.7 provides a summary of the thematic areas covered by these projects.

1

Kiribati: Kiribati Adaptation Phase III (LDCF) (P112615) (World Bank, 2011)
Project cost: US$3,400,855

Project objective:

- Improve resilience to impacts of climate change on freshwater supply and coastal infrastructure

Project outcomes included:

- Leakage detection installed and transmission mains and reservoirs repaired
- Rainwater harvesting systems completed in Banaba
- Shoreline protection on South Tarawa combined with mangrove planting
- Implementing agencies worked to engage the community, facilitated by the Project Management Units’ Community Engagement Team
- Key performance indicators for CCA and DRM developed
- Drought Response Plan and Pandemic Plan operationalised

2

Honiara, Solomon Islands: Second Road Improvement Project: Climate Adaptation Features (ADB, 2012)
Project cost: US$24,000,000; 3 years.

Project objectives:

- Design water course crossings to accept higher floods and river debris loads
- Install bridge abutments to piled foundations to minimise collapse of abutments and approach roads

Project outcomes:

- Rehabilitation of the Poha Bridge in West Guadalcanal provided a lifeline to people in rural villages such as Visale and Lambi and linked them to essential services in Honiara
- 64 kilometres of provincial and secondary roads rehabilitated, about 35 major bridges and 50 new culverts constructed, and 60,000 square metres of Honiara’s main road resealed
- The flow of some rivers realigned to allow them to pass directly under bridges

3

Honiara, Solomon Islands: Honiara City Climate Change Vulnerability and Adaptation Assessment (UN-Habitat, 2014a)
Project cost: US$4,400,000

Project objective:

- To implement key recommendations of the Solomon Islands National Development Strategy (2011–20) and the National Climate Change Policy (2012–17)

4

Apia, Samoa, Apia Samoa City Development Strategy (ADB, European Commission, UN-Habitat, UNDP, World Bank, 2011).
Project cost: US$689,500.

Project objectives:

- Support preparation of an integrated sustainable management plan for the greater Apia area using a climate proofed City Development Strategy
- Strengthen Samoa's urban management institutional framework to create more inclusive, productive, liveable, and sustainable towns

Project outcomes:

- Vulnerable communities included in the Apia Climate Vulnerability Assessment
- National Building Code revised to allow for affordable safety standards and open dialogue to incrementally improve housing

5

Port Vila, Vanuatu: Mainstreaming Disaster Risk Reduction (P129376) (World Bank, 2012)
Project cost: US$2,730,000

Project objective:

- Strengthen urban planning and tsunami preparedness in main urban areas

Project outcomes:

- Risk assessment mainstreamed into the Urban Growth Plan and the Coastal Plan for Vanuatu
- Detailed risk information informed the urban growth plan for Port Vila and the Coastal Plan
- Tsunami evacuation maps and signage prepared for urban areas
- Extensive public awareness initiatives currently underway to 100 percent of the urban communities

6

Port Vila, Vanuatu: Vanuatu Coastal Adaptation Project (UNDP-GEF, 2012)

Project objective:

- Build resilience by improving infrastructure, sustaining livelihoods, and increasing food production to improve the quality of life in targeted vulnerable areas in the coastal zone

Project outcomes:

- Recruited several key staff members within Project Implementation Unit and made steady progress in delivering Annual Work Plan for 2015 by engaging targeted coastal communities in a series of vulnerability assessments and climate change adaptation planning sessions
- Developed an approach to performing vulnerability assessments and facilitating community-based climate adaptation plans

7

Lami Town, Viti Levu, Fiji: Pacific Cities and Climate Change Initiative (UN-Habitat, 2010)

Project objective:

- Identify vulnerable areas and plan for climate change via coastal protection initiatives

Project outcomes:

- Local government is better prepared to respond before and after an emergency or disaster
- Strengthened capacity to prescribe hard and soft techniques to adapt and mitigate
- Effective governance recognised as key to the sustainability of risk management efforts (at the council and community levels)
- Continued protection of existing mangrove plantations in coastal areas
- Increased drainage and dredging of rivers to reduce flooding and erosion

8

Taro Island, Solomon Islands: Choiseul Bay Township Adaptation and Relocation Program (Solomon Islands, 2008)
Project cost: US$26 million

Project objectives:

- Relocate Choiseul Province on 488 hectares of land due to increasing threat to coastal development by climate change
- Consult with local communities to design a new town sensitive to their needs and interim adaptations

Project outcomes:

- Relocation undertaken and ongoing

9

Vanuatu Commonwealth Climate Finance Access Hub (Australian Government and Commonwealth Secretariat, 2015–20)

Project objective:

- Assist government in dealing with climate change impacts by accessing funding from a global fund of US$100 billion a year by 2020

Vanuatu is one of two South Pacific SIDS seeking assistance from the Commonwealth Climate Finance Access Hub to improve access to global finance aimed at supporting climate change adaptation and mitigation. The Hub's main objective is to minimise the deficiency in information on climate finance and to assist SIDS, particularly in preparing bankable projects. The innovative approach will build on-the-ground capacity to access multilateral funds such as the Green Climate Fund, the Adaptation Fund, and Climate Investment Funds, as well as private sector financing. The Commonwealth Climate Finance Access Hub is supported by an AUS$1 million grant from the Australian government and a £1 million grant from the Commonwealth Secretariat, plus in-kind support from the Government of Mauritius (Commonwealth Secretariat, 2016).

Enewetak Atoll, Republic of the Marshall Islands
Photo by NASA

Composite “true color” multispectral satellite image of Enewetak Atoll. 10 February 2014 - Imagery NASA/USGS. NASA/USGS Landsat satellite image GeoTIFF archive

TABLE 5.6

SUMMARY OF PACIFIC DONOR PROJECTS BY THEMATIC AREA

Source: Various

- 🟩 ACCOMMODATION
- 🟥 PROTECTION
- 🟧 CLIMATE CHANGE FINANCING
- 🟦 RESILIENCE
- 🟫 RETREAT
- ⬛ MITIGATION

PORT VILA, VANUATU
Mainstreaming Disaster Risk Reduction (P129376) (World Bank, 2012)

🟩 **Capacity building of city planning; mainstreaming disaster risk reduction into city planning; public education and awareness building.**

HONIARA, SOLOMON ISLANDS
Honiara City Climate Change Vulnerability and Adaptation Assessment (UN-Habitat, 2014)

🟩 **Assess city’s climate change vulnerability and adaptation**

KIRIBATI
Kiribati Adaptation Phase III (LDCF) (P112615) (World Bank, 2011)

🟥 **Protect coastal infrastructure**

🟦 **Build water and coastal infrastructure**

🟩 **EBA**

LAMI TOWN, VITI LEVU, FIJI
Pacific Cities and Climate Change Initiative (UN-Habitat, 2010)

🟩 **Strengthen urban governance to enhance city resiliency; engage stakeholders; EBA**

TARO ISLAND, SOLOMON ISLANDS
Choiseul Bay Township Adaptation and Relocation Program (Solomon Islands Government, 2008)

🟩 **Relocate town**

HONIARA, SOLOMON ISLANDS
Second Road Improvement Project: Climate Adaptation Features (ADB, 2012)

🟥 **Upgrade roads and bridges**

APIA, SAMOA
Apia Samoa City Development Strategy (ADB, European Commission, UN-Habitat, UNDP, World Bank, 2011)

🟩 **Build capacity for city planning; revise national building code**

PORT VILA, VANUATU
Vanuatu Coastal Adaptation Project (UNDP-GEF –LDCF, 2012)

🟥 **Improve coastal infrastructure**

🟩 **Produce community-based climate adaptation plans**

VANUATU
Commonwealth Climate Finance Access Hub (Australian Government and Commonwealth Secretariat, 2015-2020)

🟧 **Climate change financing**

Manihiki Island, Cook Islands
Photo by NASA

Using a high-magnification lens, an astronaut photographed almost the entire 10.5-kilometer long (6.5 mile) Manihiki Island, which lies in the middle of the Pacific Ocean. Image: Archive NASA. Earth Observatory – Manihiki Island – Satelite Image. September 13, 2015

5.8

CONCLUSION

Regional agencies have responded to climate change adaptation in SIDS. Additionally, donor agencies have funded projects and programmes aimed at building coastal infrastructure, strengthening in-country institutional capacity, building stakeholder awareness through knowledge-sharing, and enhancing data collection to improve decision-making. Furthermore, sector projects have addressed climate change issues related to city adaptation to climate change. Projects have included improving the water supply, improving coastal roads, defending coastlines, improving drainage to reduce flood risk, implementing a national building code, and replanting mangroves.

City adaptation and resiliency projects have attracted funding in the past 6 years. Some of these projects are still in their implementation phase and therefore it is too early to consider lessons learned or best practices. Projects have been designed to embrace hard and soft approaches to facilitate resiliency to climate change. However, both the Caribbean and the Pacific regions still have adaptation deficits that can only be closed by donors and governments paying more attention to strengthening urban governance by building human resource capacity, taking up technological and policy innovations, and engaging stakeholders.

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POLICY RECOMMENDATIONS FOR BUILDING RESILIENCY IN SIDS COASTAL CITIES

This section provides policy prescriptions to help guide decision-making to climate proof and build resiliency in SIDS coastal cities. Reference is made to projects funded by donors to support policy recommendations. However, some of these projects are ongoing and therefore it is premature to distil lessons learned. Projects that have been completed are cited and the main lessons are provided.

6.2

MULTI-PRONGED APPROACH

Building city resilience should be relevant to the uniqueness of SIDS local circumstances, capacity, and access to resources. The experience of Caribbean and Pacific SIDS confirms that no single mitigation or adaptation policy can be applied to all SIDS. In short, there is no "one size fits all" approach. Fortunately, national adaptation plans can be used to outline each country's broad adaptation agenda, synergies with donor priorities, and opportunities for urban adaptation. Measures may be drawn from an array of hard and soft solutions and can be applied alone or in combination, depending on the specific geographical and socio-economical characteristics of the SIDS. Reactive and standalone efforts to reduce climate-related risks to coasts are less effective than responses that are part of ICZM (Mycoo and Chadwick, 2012; Mycoo, 2014b).

SIDS have been pioneering innovative approaches to adapt to climate change in LECZ cities. Georgetown, Guyana; Paramaribo, Suriname; and Nassau, Bahamas, are examples of LECZ cities that have used a mix of protective, retreat, and accommodation measures in response to the impacts of climate change. In SIDS, building seawalls, creating coastal setbacks, building on stilts, replanting forests and mangroves, ICZM, using building codes, mapping hazards, increasing public awareness, and transferring risk using insurance are among the many approaches used to adapt to climate change and build resilience. Mycoo and Chadwick (2012) studied coastal setbacks in Barbados. Simpson, Mercer Clarke, Clarke, et al. (2012), building on earlier research by Cambers (1998), prepared a comprehensive report on using coastal setbacks to protect population, infrastructure, and investments in the coastal zone of Caribbean SIDS that should guide planning in Caribbean cities.

There are several examples of projects that focus on strategies to adapt to climate change and measures that have been implemented in SIDS. The Sea and River Defence Resilience Project funded by the CDB combined hard engineering and soft measures to adapt to the impacts of climate change. Specific measures included reconstructing sea and river defences, building capacity in shoreline monitoring, and using geographical information systems, as well as enhancing public awareness. Fiji received funding from UN Habitat to build coastal infrastructure as protection for vulnerable urban areas. The IDB also provided financing to Barbados to implement ICZM, including constructing coastal defences, EBA, building codes, and coastal setbacks. These practices provide useful lessons and should be mainstreamed into policy and decision-making in SIDS that are getting ready to climate proof.

Relocating capital cities is one of the strategies available to SIDS, but it should be used only as a last resort. For example, relocating Taro Island, the capital of the province of Choiseul, Solomon Island, was a lengthy and costly exercise. Further, this strategy has multiple socio-economic repercussions and high political costs (UNISDR, 2012). A social cost–benefit analysis should be conducted before any decision is made to relocate the population of SIDS coastal cities.

Urban adaptation to climate change in most SIDS has focused on specific formal strategies and implementation measures. Sometimes, this has led to maladaptation among economically disadvantaged communities. For example, in Georgetown, Guyana, households have elevated their lots and built drains to quickly carry away floodwaters, but in so doing, they have caused flooding elsewhere (Mycoo, 2014a). Less attention has been paid to responses to climate change that occur outside formal policy channels, which are likely to be those that are common among the poor.

Urban adaptation strategies should "consider the inter-linkages between formal and informal action in adaptation; the integration of different knowledge types (scientific and social); assessments of cross-scale secondary effects of specific measures; the identification of potential conflicts between specific adaptation strategies; the integration of urban climate change adaptation with wider sustainable development; and limits and tipping points with respect to adaptation options" (Birkmann, Garschagen, Kraas, et al., 2010).

6.3

INTEGRATED PLANNING

The limitations of uni-sectoral strategies have been recognised among SIDS. Efforts should focus on encouraging integrated planning processes and policy working across multiple scales and sectors. Adaptation decisions, including which technologies to implement, should take place within the framework of ICZM which provides a good platform for considering diverse adaptation options available and the large number of stakeholders involved in decision-making in the coastal zone (Zhu et al., 2010). Barbados provides one of the best models for ICZM in the Caribbean and attempts have been made to replicate it in countries such as Saint Lucia, Trinidad and Tobago, and Jamaica.

Engaging urban governments, households, communities, and the private sector should be facilitated. Stakeholders such as donors, national governments, universities, research institutions, and professional organisations (e.g., city planners) play a vital role in supporting SIDS city resiliency. As such, professionals in the Caribbean and the Pacific have been working closely with researchers and donor agencies such as the IDB, DFID, the European Union, the United Nations, the World Bank, AUSAid, USAID, the Commonwealth Foundation, the CDB; regional partners such as the CCCCC, CDEMA, and the OECS; as well as national governments, The University of the West Indies, and The University of the South Pacific to focus activity on city resiliency. An enabling environment to deepen collaboration among these actors should be high on the future agenda.

A unit responsible for disseminating new knowledge should be created within the city government, drawing together relevant data, informing key politicians and civil servants, encouraging engagement by different sectors and departments, and consulting with key stakeholders.

A framework for urban governance should be developed and it should enhance interactions among:

- *Knowledge producers:* academic science, community, business, and non-governmental organisation produced research
- *Knowledge actors or users:* most importantly, local government often in collaboration with partners
- *Knowledge filters:* the media and lobby groups who can mediate between knowledge production and action (Carvalho and Burgess, 2005; Leiserowitz, 2006; Ashley Ashley, Blanskby, Newman et al., 2012)

Donors and researchers have found that an increase in community awareness and knowledge of disaster risk, climate change, and the impact of human actions and activities on coastal areas can influence positive behavioural change (Mycoo, 2015). Good governance should facilitate mediation of policies and decisions across different actors, spheres of influence, sources of information, and resources to co-produce knowledge and support learning and action over time.

Mainstreaming urban adaptation into local government is not simple for SIDS, which already face economic hardship. Furthermore, historically and in the contemporary period, local governments throughout the Caribbean and the Pacific lack fiscal autonomy, depend on central government for subventions, have limited institutional capacity, and therefore have limited mandates. It is possible that local authorities with existing limited resources may prioritise conventional economic and development goals over "environmental" issues, including adapting to climate change. In these circumstances, national governments need to work collaboratively with local governments to climate proof cities and coastal regions. Numerous examples exist in many countries of the Global South where mainstreaming climate change through local government policies and planning ensures that investments and actions by businesses and households contribute to adaptation. Building the capacity of local governments in adapting to climate change should, therefore, be a long-term goal. In particular, mainstreaming adaptation to climate change should be initiated by encouraging pilot projects that help ground adaptation in practical reality. For example, UN-Habitat funded a climate change initiative in Lami Town, Fiji, that resulted in strengthening local government capacity to prioritise soft and hard adaptation strategies.

Community-based adaptation should be promoted as part of cities adapting and building resiliency in SIDS. In most cities and neighbourhoods, where infrastructure coverage is incomplete and household incomes are limited, communities offer a rich resource of adaptive capacity to cope and to prepare for future risk. Communities should be mobilised to map and enumerate their informal settlements. Data collected from these activities should be used to plan infrastructure and services and to help identify risks and vulnerabilities to extreme weather and other hazards. Vanuatu's coastal adaptation project, funded by the UNDP-GEF, successfully produced community-based adaptation plans. The lesson drawn from this project is that plans are best developed through community engagement.

Furthermore, cities are composed of complex inter-dependent systems that should be leveraged to facilitate adapting to climate change through effective municipal governments supported by multilevel governance where such governance structures apply to SIDS. The approach should be adopted to enable synergies with infrastructure investment and maintenance, land use management, and ecosystem protection services (Nurse et al., 2014). The main components of integrated planning are discussed below.

6.3.1

PROMOTE MORE SUSTAINABLE URBAN PLANNING AND CITY FORM

Urban planning should play a key role in responding to climate change challenges and building resiliency. Realistic city planning policies and stronger implementation capacity are needed to improve resiliency in the face of climate change. Historically weak urban planning agencies in both Caribbean and Pacific SIDS will need to overcome their limitations, such as political interference, poor data quality, limited staffing resources, and access to new tools and technologies. The devolution of planning to municipalities of the larger SIDS may help bring communities closer to urban planners and yield better and faster decisions on applications for building approval that in the long term may lessen political interference. Additionally, overcoming delays in decision-making may help improve stakeholder compliance with development guidelines and lower maladaptation responses to climate change. Better coordination between the urban planning agency and other departments that have input in planning decisions may also reduce delays in decision-making. Poor data quality has also limited the institutional capacity of urban planning agencies in SIDS to produce more sound physical plans and policies. Enhanced data sharing and access to more efficient data capture and processing technology would help strengthen the institutional capacity of urban planning agencies to develop and mainstream climate change relevant policies and plans. The shortage of urban planners in some Caribbean and Pacific SIDS could be addressed by offering more tertiary education courses in these two regions. These could be conducted online to reduce travel costs for the participants. Donor agencies could also support training by funding scholarships.

In many SIDS, outdated urban development plans, archaic policies, and irrelevant development standards have made stakeholder compliance very difficult and pose increasing danger in the context of climate change. Land use zoning, building codes, and infrastructure standards should be revised to improve climate change resiliency. Additionally, the private sector should be mobilised to support zoning policies by raising insurance premiums and coverage in areas that are flood prone.

Apart from the national climate change adaptation plans that have been developed in some SIDS, municipal and higher-level adaptation plans need to take into account uncertainty about future climates and extremes. They need to consider direct and indirect economic costs, including the trade-off of inaction and locking into ill-adapted infrastructure versus investment in adaptation when climate change is less than anticipated.

Urban sprawl needs to be contained because it predisposes SIDS to high levels of vulnerability to climate change. SIDS should adopt policies that support a more compact urban form to minimise urban sprawl given the limited availability of land. There are several advantages associated with containing urban sprawl. Promoting compact cities would help save rainforests and watersheds that play a critical role in slowing surface water runoff and improving ground water infiltration. Ultimately, compact city form would help reduce flooding in low-lying coastal cities. Policies aimed at reducing sprawl would also help reduce the attractiveness of hazard prone coastal lands where the poor tend to settle. Additionally, the poor would have better access to economic opportunities and services within core settlements with a compact urban form.

A more compact urban form should be explored using smart principles. Tools for achieving a more compact urban form, including those that reduce urban sprawl, should be given careful consideration. These include establishing greenbelts, land use zoning regulations that control expansion into greenfield sites, promoting higher densities in urban areas and those identified for new housing projects, and regenerating underutilised sites or areas that have suffered from urban decay. Although establishing greenbelts has attracted criticism because of its adverse effects on urban land supply, which in turn results in informal settlements and leapfrogged development, greenbelts represent an EBA to climate change. Greenbelts reduce the conversion of rural land to urban development. By preserving vegetative cover, they also help reduce rapid surface water runoff and consequently mitigate flooding.

Urban planning exercises should reinforce existing stakeholder relationships and encourage partnerships among all urban stakeholders. As development agencies and donors have recommended, when implementing adaptation measures, it is important to

(i) *understand the legitimate concerns and interests of stakeholders and*

(ii) *explain and convince the local community of a project's merits, manage expectations, and develop stakeholder ownership.*

Furthermore, it is especially important that planners, architects, engineers, disaster and risk reduction management specialists, sector specialists, the private sector, and communities work as a team to address adaptation and resilience in a holistic manner. In SIDS faced with human resource constraints and a limited number of these professionals, training programmes should be developed to close these gaps.

Urban policies should be embodied in laws, regulations, guidelines, and programmes thus leading to action and positive results on the ground. Policies aimed at achieving resiliency should emphasise, encourage, and reward synergies and co-benefits. Furthermore, given that law enforcement is weak in most SIDS jurisdictions, market incentives should be explored as complementary measures to improve policy compliance. Examples include tax deductions and subsidies.

The following are other urban planning policies that could be used to restore coastal ecosystems in cities:

- *Sustainable waterfront planning:* Cities are beginning to realise the economic potential of their waterfronts and the need to preserve them. Detailed action plans and a clear road map to reform a city's waterfront are critical. Bridgetown has been recognised for its work in this area. Outside of the Caribbean, "Vision 2020: New York City Comprehensive Waterfront Plan" provides another model. It contains provisions to restore coastal and maritime forests, expand use of waterfront for parks, and "[r]evise zoning to encourage redevelopment and reuse of waterfront industrial sites" (NYC, 2011)

- *Bluebelts:* Just as cities have designated greenbelts, coastal cities can create bluebelts to protect coastal areas. Bluebelts preserve natural drainage corridors, including streams, ponds, and other wetland areas. Preserving these wetland systems allows them to store and filter storm water

- *Supporting more water-sensitive urban design:* Local governments are increasingly redesigning public spaces and plazas to collect and store rainwater during storm events. While the experience is limited in SIDS, many planners look to the Netherlands. For example, Rotterdam's Watersquare Benthemplein is the world's first public water park fed by collected rainwater. The water square offers an outdoor sports venue, green areas, and even a theatre for locals and visitors. The water is collected and stored in basins that are visible to the public (Zimmer, 2014)

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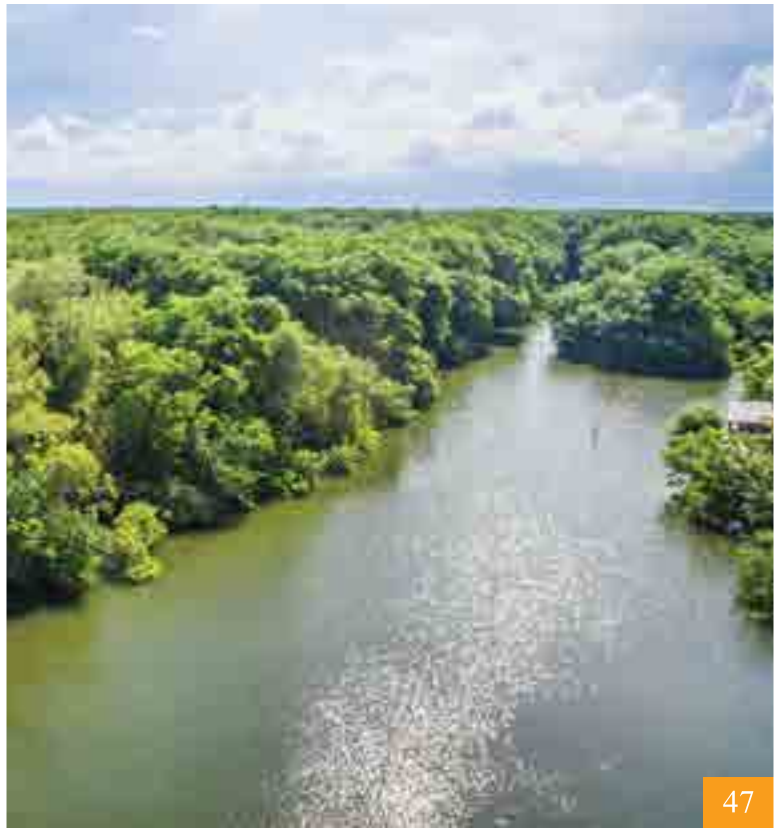

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6.3.2

INSTITUTIONAL CAPACITY BUILDING

Capacity building is essential to mainstream urban planning, adaptation, and natural hazard risk reduction policies into climate change adaptation and to build resiliency in SIDS coastal cities. Expertise in developing climate-resilient cities should be a high priority in any future agenda for SIDS. New technologies and good practices in other regions provide SIDS with opportunities to meet climate change challenges. Drawing from these innovative tools and practices, SIDS should strengthen their capacity building and retooling of locals to adopt innovative technologies. Regional training programmes and workshops is a good modality to deliver technical training for new tools and techniques.

So far, in collaboration with donor agencies, national governments have been instrumental in conducting training programmes. For example, the CDB has successfully conducted training programmes in the Caribbean. The World Bank, the IDB, the ADB, and the European Union can play an important role in funding training programmes for universities, professional planning associations, and public planning agencies. Training trainers in other thematic areas has been effective in many SIDS and can be used as a training model for uptake and scaling-up.

6.3.3

LEADERSHIP, STAFFING, AND SKILL DEVELOPMENT

Leadership is critical to generate interest in urban adaptation and champion awareness and institutional change to bring action (Anguelovski and Carmin, 2011; Carmin, Nadkarni, and Rhie, et al., 2012). Creating a climate change and environmental focal point or office in a city can help coordinate climate action across government departments or agencies (Roberts, 2008, 2010; Anguelovski and Carmin, 2011; Hunt and Watkiss, 2011; OECD, 2011; Brown et al., 2012). Yet, there may be downsides when this function is housed in the environmental line department since it is typically among the weakest parts of city government, with limited influence, as in Jamaica, Trinidad, and Guyana. Environmental management authorities in some OECS territories are under-resourced to perform their main functions. Moreover, projects often proceed with the approval of the political directorate without environmental impact assessments or strategic environmental assessments (Mycoo, 2005).

Although there is growing evidence of leadership for urban adaptation (Lowe, Foster, and Winkelman et al., 2009; Anguelovski and Carmin, 2011; Foster, Lowe, and Winkelman, 2011b), there are also important political constraints at the local level. Powerful vested interests may oppose attention to adaptation and promote development on sites at risk. Additionally, concerns about employment and competitiveness make it difficult for local governments to focus on the more distant implications of climate change. This is especially so during periods of economic hardship (Shaw and Theobald, 2011; Solecki, 2012). An essential step forward is to institutionalise behavioural change and different types of norms.

Beyond goal setting and planning, the literature also suggests the need for regulatory frameworks that require relevant behaviour and investment. Additionally, governments can institute small changes, such as job descriptions that require actions and provide incentives to act in new ways (e.g., for line managers and sector policymakers) or by providing training and clear guidance to staff (Moser, 2006; Carmin, Chu, and Dodman, et al., 2013; Tavares and Santos, 2013). Budgetary transparency and metrics to measure progress on adaptation can also help institutionalise changes in planning and policy practice (OECD, 2012).

6.4

ADAPTING HOUSING AND INFORMAL SETTLEMENTS

In SIDS, urgent attention is needed in cities where housing quality is low, where settlements are on high-risk sites, and in cities where climate change impacts are greatest. Enhancing the resilience of buildings that house low-income groups is usually expensive and may face political challenges (Roaf, Crichton, and Nicol, 2009). The range of actors in the housing sector, the myriad connections to other sectors, and the need to promote mitigation and adaptation, as well as development goals, point to the importance of well-coordinated strategies that should support resilience (Maller and Strengers, 2011).

As the Pacific and Caribbean coasts urbanise, it will be critically important to incorporate risk reduction into the location and design of social housing. As the Barbados Habitat III report indicates, "the ability of buildings to withstand high winds, flooding, and seismic activity is of paramount importance if the country is to maintain and expand its housing stock" (SALISES and CERMES, 2015). Housing quality should be improved, especially in older parts of the city and in areas where informal urban settlements have occurred. Some SIDS are making progress in this area.

The resilience of poor quality housing, often at risk from extreme weather, should be enhanced using structural retrofitting and interventions that reduce risks, such as flood-proofing houses or expanding drainage capacity to limit or remove flood risks. Housing ministries should adopt new designs to increase the resilience of coastal housing by

(i) *ensuring that the floor levels of social housing are above recorded flood levels,*

(ii) *improving standards for the foundations of social housing to guarantee that structures can withstand dynamic water forces, and*

(iii) *altering roof designs to ensure adequate resistance in high winds. Moreover, the future siting and design of social housing should be informed by coastal hazard risk assessments and coastal setback requirements for new developments (Simpson et al., 2012).*

USAid and the Organisation of American States have funded several projects in the Caribbean to build hurricane-resistant housing. The main lesson drawn from these projects is that strong enforcement capacity in city planning agencies is necessary to ensure household compliance in adopting the building code for hurricane-resistant housing. In Castries and Anse La Raye, Saint Lucia households have at times rebuilt hastily in the aftermath of hurricanes without adhering to the hurricane-resistant designs and coastal setbacks (Mycoo, 2011b).

6.5

ADAPTING URBAN WATER SUPPLY

It is forecasted that the Caribbean will be the only insular region in the world to experience a decrease in water availability in the future (UNDP, 2016). Furthermore, droughts have struck many SIDS in the past decade, so much so that in many urban areas, households have had to purchase water. Stronger water management policies should be implemented to minimise water loss. Water pricing is an effective tool to minimise water consumption and loss, but social equity should not be compromised (Mycoo, 2011a; Mycoo, 2011c). Barbados and Jamaica have both demonstrated the effectiveness of water pricing in curbing wastage of water resources. Additionally, rainwater harvesting and water recycling should be promoted throughout SIDS cities where coastal aquifers have been damaged. This is especially important given the more severe dry seasons when water levels are low in the reservoirs. Other measures could include water rationing, reuse of grey water, consumer education, and technological solutions such as low-flow systems or dual flush toilets. Desalinisation plants should be avoided given that they are costly to construct and maintain, and have significant environmental impacts.

6.6

CLIMATE-RESILIENT COASTAL INFRASTRUCTURE

Many SIDS have developed highways along the coast, but these have become increasingly vulnerable to SLR, coastal erosion, and flooding. Cities are often cut off from other parts of the country during severe flooding. Adapting coastal roads should be a priority. To cope with SLR, investments should be made to realign roads, relocate very vulnerable roads to higher elevations, and strengthen barriers such as seawalls to protect highways. In some cases, restoring mangroves may protect existing roads. See Figure 6.1 for an example of coastal road protection on the Palisadoes in Jamaica. This is a sand spit linking Kingston to the Norman Manley International Airport.

NASSAU, BAHAMAS.
BREAKWATER. JUNE, 2004

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NASSAU, BAHAMS. CONSTRUCTION
OF GABION BASKETS. JUNE, 2004

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6.7

PROMOTE ECOSYSTEMS-BASED APPROACHES AND GREEN INFRASTRUCTURE

Many SIDS should be mainstreaming soft infrastructure such as EBAs in their climate change adaptation plans since they have tremendous potential to minimise risks and vulnerabilities to natural hazards. EBAs have proven to be effective in many coastal zones in Caribbean and Pacific SIDS. For example, SIDS' natural ecosystems, such as protecting wetlands and replanting mangroves, have been cost-effective tools in protecting settlements from coastal hazards. The mainstreaming of EBAs into land use planning policies for SIDS cities is highly recommended. The main lessons learned from EBAs are that they cost less to maintain than coastal engineering projects, are well suited to community involvement in implementation, are less harmful to the natural environment, and promote attaining environmental sustainability, and they may generate livelihoods for people living in areas where they are implemented. EBAs have been used in projects funded by UNDP-GEF in Kingston, Jamaica and the World Bank in Georgetown, Guyana, and Kiribati. The World Bank promoted replanting mangroves.

Green infrastructure refers to interventions to preserve the functionality of existing green landscapes (e.g., parks, forests, wetlands, and greenbelts) and to transform the built environment using phytoremediation and water management techniques and by introducing productive landscapes (Zhang et al., 2011). Many SIDS have embarked on watershed management, afforestation, and wetland conservation, including replanting mangroves, as part of their strategy to adapt to climate change. Greater use should be made of green infrastructure at the city level to influence the effectiveness of pervious surfaces used in storm water management, green/white/blue roofs, wetlands used for flood protection, urban agriculture, and overall biomass production.

6.8

PRIORITIZE INVESTMENTS

Investments should be prioritised to ensure that competing projects with limited impact do not take precedence over those that are critical to climate change adaptation. Failure to prioritise may result in the non-implementation of urgent projects to adapt to climate change. Additionally, policies and plans for adaptation and resilience should prioritise the resilience of systems to ensure basic urban services can continue to be provided. This could begin by identifying existing and planned facilities and processes considered critical—those that are essential to the continuity of basic services after environmental and natural disasters.

A framework to prioritise investments should be used, such as the National Public Investment System developed by the IDB. The IDB is currently funding a project to mainstream disaster risk management and climate change adaptation in national public investment systems in The Bahamas, Guyana, Jamaica, Trinidad and Tobago, and Barbados.

Additionally, three decision-making frameworks are widely used and they have all been recommended for use in NAPAs under appropriate circumstances (UNFCCC, 2002):

1. Cost–benefit analysis: An assessment of all the costs and benefits of alternative options
2. Cost-effectiveness analysis: An assessment of the purely financial costs of alternative options that all achieve the same objective
3. Multi-criteria analysis: A comparative assessment of options, taking into account several criteria simultaneously, that is mainly used to assess impacts that cannot readily be quantified in monetary terms

Of these three approaches, cost–benefit analysis is the only one that can optimise and prioritise options. However, it is limited because both costs and benefits must be expressed in monetary terms and its chief objective is economic efficiency. SIDS should weigh the use of this method in project investments.

6.9

INTEGRATED CLIMATE CHANGE, DISASTER RISK REDUCTION, POVERTY REDUCTION AND CITY RESILIENCY

An emphasis on single purpose projects and a tendency among sectoral agencies to operate in silos minimises the positive impact of initiatives to adapt to climate change. Actions to reduce exposure and improve the adaptive capacity of urban populations must simultaneously address reducing disaster risk, reducing urban poverty, and increasing urban resilience.

Increasingly, SIDS are incorporating disaster risk reduction into national plans and a growing number have successfully incorporated disaster risk reduction policies into urban plans. Kiribati has successfully mainstreamed these policies into urban plans with funding from the World Bank. Reducing disaster risk is being promoted as an integral part of integrated planning. These case studies reveal that it should be incorporated into urban planning, coastal zone management, and planning for sectors such as housing, urban infrastructure, and urban services. Along with better structural defences, cities should have better crisis management and contingency planning, including early warning systems and evacuation plans. There is considerable scope in international frameworks and national responsibilities for better coordination to make urban disaster risk management more climate-resilient.

It should be emphasised that, given the numerous projects in SIDS that are funded by donors, there is a strong need to ensure that these are better coordinated to avoid duplication of effort in a resource constrained environment. Moreover, these projects should not be conceived as standalone projects. An integral part of the future agenda needs to be integrating projects into wider sustainable urban development activities.

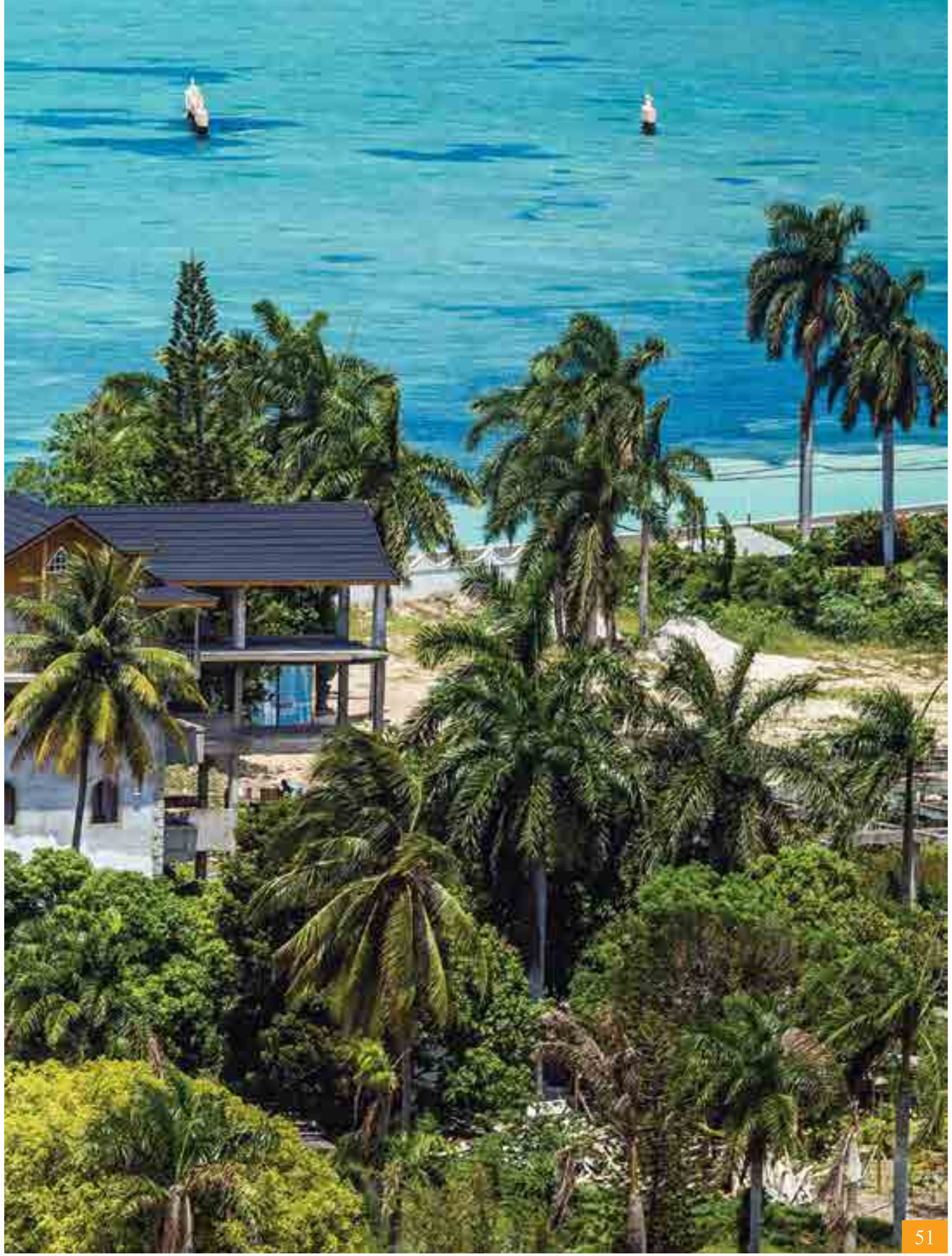
6.10

STRENGTHENING CAPACITY FOR ACQUISITION OF LOCAL DATA AND BUILDING SIDS INFORMATION SYSTEMS

A critical aspect of urban governance in response to climate change is the availability of and access to scientific information. In many SIDS, the paucity of data has been a barrier to improving decision-making on measures to adapt to climate change and build resiliency. Without data, policies and plans lack rigour and therefore cannot effectively guide decision-making. Knowledge is needed on relative SLR scenarios, extreme water levels, local wave climate, tidal regime and nearshore bathymetry, the flooding potential of a locale, and coastal erosion. Weather and climate data are required to understand changing trends in SIDS and to enhance decision-making on responses to flooding and droughts. Additionally, data on urbanisation trends are necessary to inform policies on settlement and providing services and infrastructure to make cities resilient. Satellite imagery has been useful in data capture, but SIDS-appropriate imagery is required. It is accepted that imagery at a much smaller scale (approximately 1 kilometre) is required for SIDS compared to the general scale of remote sensing imagery (10 kilometres) (UN-Habitat, 2015). Ultimately, capturing information from communities and involving them in generating knowledge and decision-making, in addition to engaging with regional partners, would ensure a more robust database and informed actions.

Data requirements on a country basis should be mapped and data gaps determined. The role of the CCCCC is key to data sharing. Additionally, new technologies for data acquisition should be accessible to policymakers. Training in using new technologies such as geographic information systems, airborne laser scanning, and LandStat should be made available throughout government departments that are responsible for climate change adaptation. Given that airborne laser scanning is cost prohibitive for many SIDS, unmanned aerial vehicles and photogrammetry should be considered as alternatives. Additionally, the donor community should continue to provide assistance in funding programmes with data acquisition and management components.

Designing and applying evidence-based policy relies on the ability to optimise opportunities in cities to create an institutionalised nexus between knowledge and practice. Knowledge generation and utilisation go beyond the scientific. Recent work has explored the potential for experiments in inclusive, citizen-led urban planning and resource management to offer an alternative institutional architecture for urban development (Mitlin, 2012). The aim is not to find a single model for improved urban government to meet the multiple and interdependent challenges of the 21st century. The aim is to see the coming decades as a prime opportunity to scope the range of experiments and embedded models that confront the challenges of sustainability for coastal cities. Further, it is to ask how far such experiments are transferable and how far they can contribute to transforming urban development (Lamond, Bhattacharya, and Bloch, 2012). The invaluable contribution that local communities can make in generating local knowledge should not be underestimated. Providing data from key stakeholders is paramount to monitoring and evaluating the success of projects to adapt to climate change. Every effort should be made to enhance the participation of local communities and community-based organisations in collecting data and co-generating and transferring knowledge using tools such as participatory mapping. UNDP-GEF has funded projects throughout the Caribbean and Pacific to use 3 D modelling and participatory mapping to help coastal communities understand the dynamics of climate change vulnerability and to advance the uptake of adaptation strategies.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6.11

DEVELOPING THE METRICS TO MEASURE SUCCESS IN CITY ADAPTATION

So far, SIDS have largely depended on donor agencies to measure and monitor adaptation success. However, SIDS cities should develop internal capacity to measure and monitor their success in adapting to climate change and enhancing resiliency. Without this capacity, they cannot track their progress and identify ways to strengthen resiliency. The following are among the metrics that should be collected:

- Human deaths and injuries from extreme weather
- Number of permanently or temporarily displaced people and others directly and indirectly affected
- Impact on properties, measured in terms of number of buildings damaged or destroyed
- Impact on infrastructure, services, and lifelines
- Impact on ecosystem services
- Impact on psychological wellbeing and sense of security
- Financial or economic loss (including insurance loss)
- Impact on individual, household, and community coping capacity and need for external assistance

The World Bank has funded building a data platform to monitor and evaluate climate change impacts and the need for risk management in Castries, Saint Lucia.

6.12

MONITORING AND EVALUATING CITY ADAPTATION

As part of the way forward, indicators to measure the success of urban adaptation activity are needed. Monitoring is challenging given the lack of standard metrics, the differences in local contexts, and the localised nature of adaptation. Monitoring and adaptation frameworks that are tailored to SIDS cities should be developed. Consistent and internationally harmonised data collection to support monitoring is urgently required. An adaptive capacity index should be developed to help SIDS cities determine risks and adaptation options at the city level. This is especially important where gaps exist between national- and city-level adaptive capacity.

Monitoring the use of international financing in assisting SIDS cities to become more resilient to climate change should form part of the new agenda. New evidence is emerging that international agencies may inadvertently overburden countries and city agencies with monitoring requirements. Some SIDS are hamstrung by limited local capacity to monitor project success and this may constrain improved project design and implementation. Training in project monitoring and evaluation is highly recommended. The CDB funded capacity building for shoreline change monitoring in Georgetown, Guyana.

6.13

TECHNOLOGY AND CLIMATE CHANGE ADAPTATION IN SIDS COASTAL CITIES

Technology should play a key role at different stages of adaptation in coastal cities of SIDS. Technology should be acquired to improve data collection for analysis and knowledge awareness, plan and design cities, implement coastal infrastructure projects, and monitor and evaluate projects (see Table 6.1). As part of its funding for the sea and river defences project in Georgetown, Guyana, the CDB provided staff training in developing a geographic information system. UNDP-GEF is promoting introducing renewable energy technologies to enable the development of zero net energy buildings in urban areas of Jamaica.

FIGURE 6.1

ROLE OF TECHNOLOGIES IN THE KEY STAGES OF ADAPTATION IN REDUCING CLIMATE RISK FOR THE COASTAL SECTOR

Source: Klein, Alam, Burton, et al. (2006).

Stage of Adaptation	Role of Technologies (Examples from the coastal zone sector)
Collect data, provide information, and increase awareness about adaptation to climate change	Mapping and surveying, satellite remote sensing, airborne laser scanning, unmanned aerial vehicles, photogrammetry, coastal vulnerability index, computerised simulation models
Plan and design	Geographical information systems for spatial planning
Implement	Dykes, levees, floodwalls, saltwater-intrusion barriers, dune restoration and creation, early-warning systems
Monitor and evaluate	Basically the same technologies as in the data collection stage. Effective evaluation requires a reliable set of data or indicators, collected at regular intervals, using an appropriate monitoring system

6.14

FINANCING COASTAL CITY ADAPTATION

In relative terms, SIDS are likely to have much higher adaptation needs, and a failure to implement early adaptation in these regions will have a disproportionate impact by widening the existing adaptation deficit (Olhoff, Alverson, Puig, et al, 2014). Furthermore, several SIDS have underscored the incorporation of the key COP21 elements into their national climate change adaptation action plans. However, access to funding will be fundamental. Developing countries face financing challenges and the main issues revolve around dependence of cities on intergovernmental transfers, low capacity to raise revenues for investments, and limited funding for local entrepreneurs (World Bank, 2016). Cities in the developing world also struggle to raise resources to fund their investment needs and at times struggle to fund ongoing public services because of unfunded mandates, limited sources of locally generated revenue, and a lack of creditworthiness (World Bank, 2016b).

Recommendations for domestic and international financing and donor funding for SIDS are discussed below. It is important to note that fiscal policies should realistically reflect local circumstances.

6.14.1

DOMESTIC FINANCING: TAPPING INTO NATIONAL OR SUBNATIONAL REGIONAL SOURCES OF FUNDING AND SUPPORT

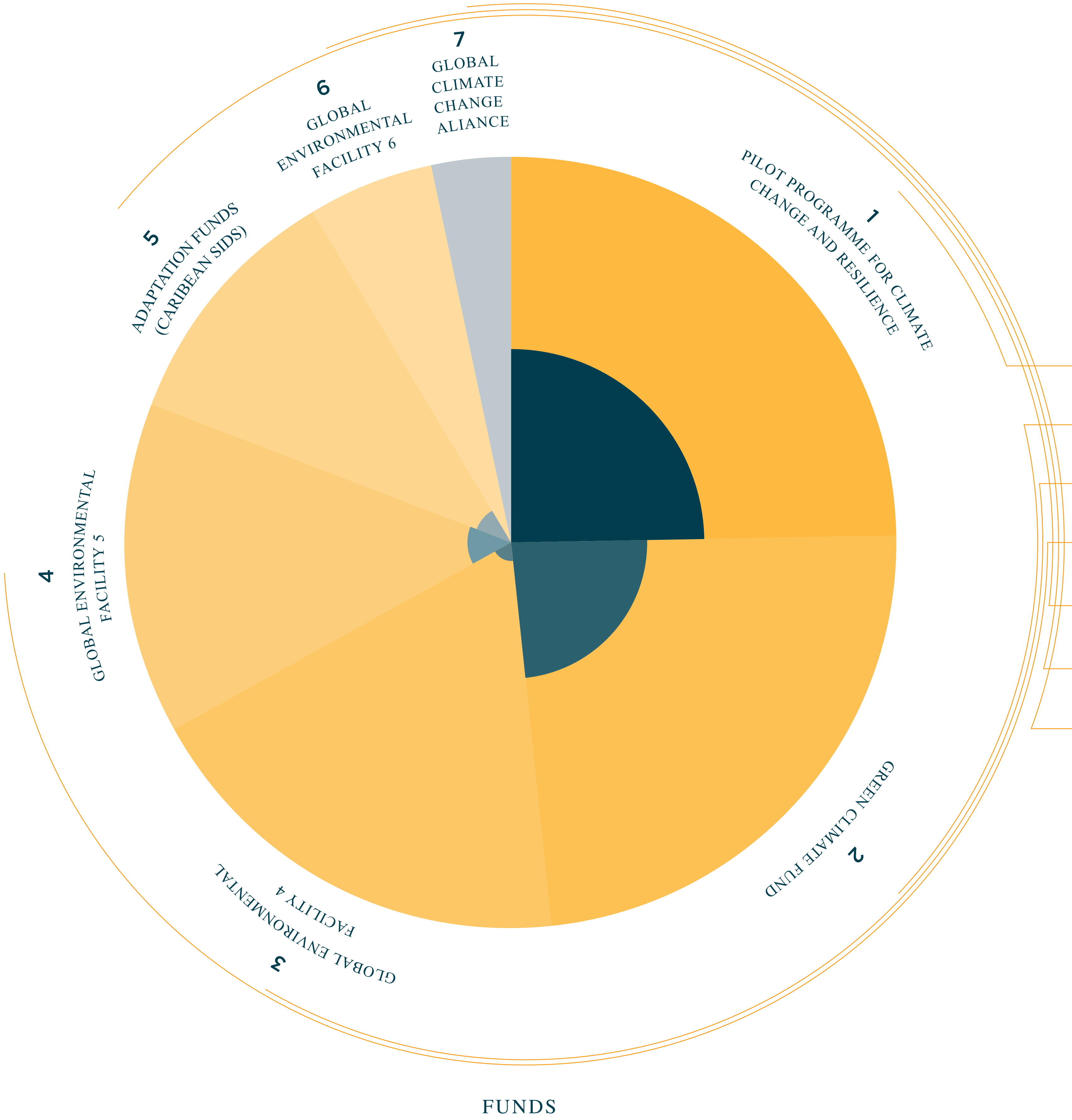
Domestic public funding is one of the most significant and sustainable sources of financing in SIDS. Many governments in the Caribbean and the Pacific have financed coastal protection projects. However, governments in both regions should explore a wider array of fiscal measures to mobilise funds domestically. These funds are necessary to support climate change adaptation projects and deal with the very high costs of extreme weather events in many SIDS cities described earlier. Fiscal measures may include:

- Green local fiscal policies such as congestion charges on motor vehicles would help mitigate GHG emissions. Market incentives aimed at reducing risk could include land price adjustments. The threat of lower resale value could provide incentives to implement mitigation and adaptation measures (Lamond, 2011)
- Grants, loans, and subventions from national or regional (subnational) governments are also important sources of funding. For example, local governments could be compensated for spending on ecosystem management as an incentive to get actively involved in adaptation at the local level
- Revolving funds should be developed from a variety of revenue streams such as Clean Development Mechanism projects (Oliveira, 2009) and savings from energy efficiency investments in municipal buildings. These projects could feed public funds for investments in further projects that could yield adaptation benefits. Energy-efficient renovations in residential and commercial buildings could be promoted by granting subsidies and tax rebates to homeowners and businesses

6.14.2

INTERNATIONAL FINANCING AND DONOR ASSISTANCE FOR CITY ADAPTATION

Policymakers in SIDS are dissatisfied with the current level of international adaptation financing and perceive accessing multilateral financing such as the Adaptation Fund as difficult (Robinson and Dornan, 2016). However, empirical evidence confirms that SIDS are not disadvantaged in accessing international climate adaptation funding, though there remains a large gap between the levels of adaptation funding and the projected amount required to adequately adapt to climate change (Robinson and Dornan, 2016). Several Caribbean SIDS have been successfully secured assistance particularly from the Global Climate Change Alliance, the Green Climate Fund, and the Pilot Programme for Climate Change and Resilience (see Table 6.2). Table 6.3 shows that SIDS have received bilateral and multilateral climate funding totalling US$794 million. The Caribbean has been allocated more funds than the Pacific.



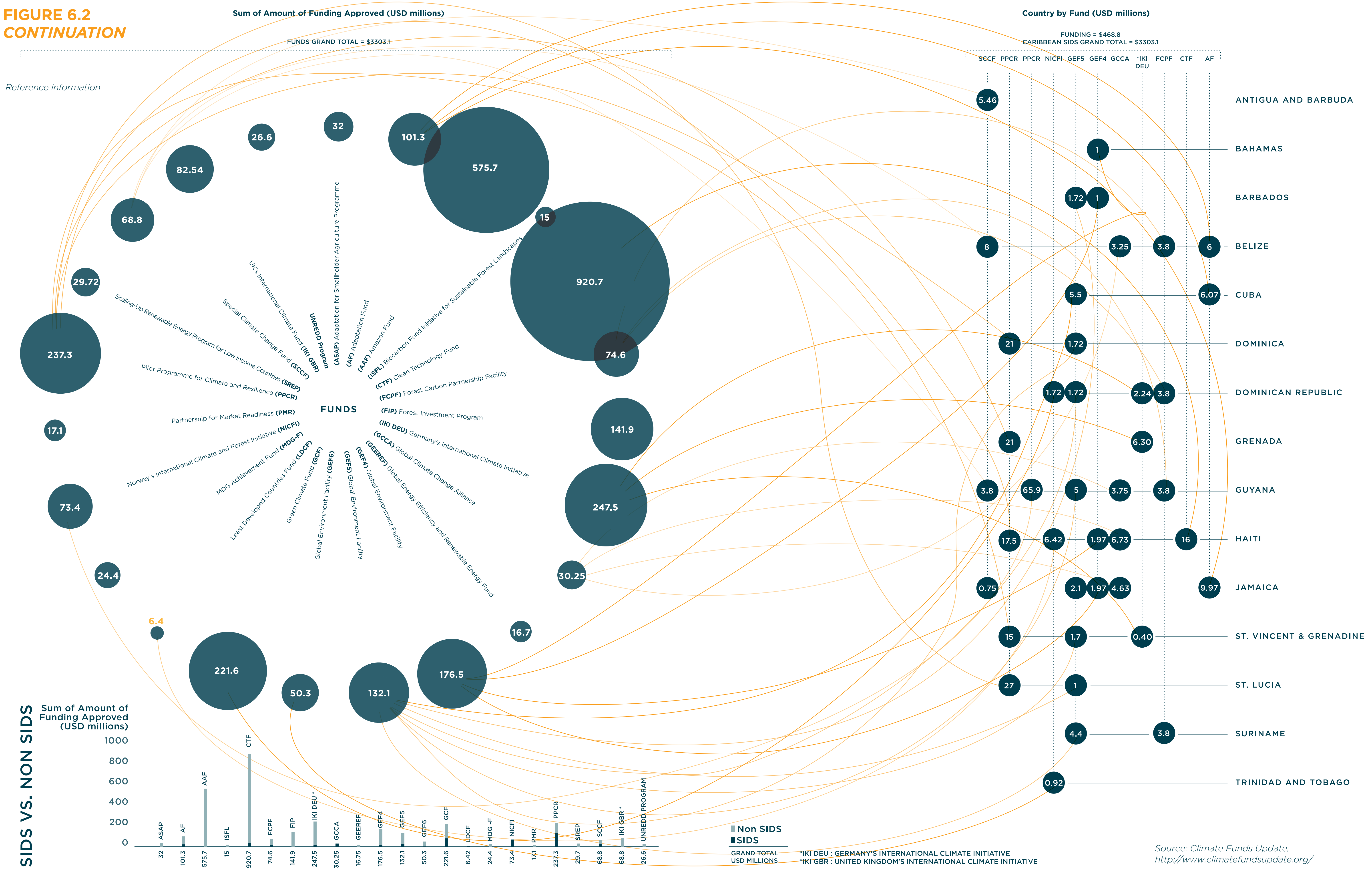
	US$ MILLION	% OF FUNDS IN LATIN AMERICA AND THE CARIBBEAN ALLOCATED TO CARIBBEAN SIDS
1	115	48.6%
2	81	36.3%
3	11	6.3%
4	26	19.6%
5	22	22%
6	0.9	1.8%
7	30	100%

FIGURE 6.2

CLIMATE FUNDS APPROVED: PACIFIC AND CARIBBEAN SIDS

Source: Climate Funds Update, http://www.climatefundsupdate.org/

FIGURE 6.2
CONTINUATION



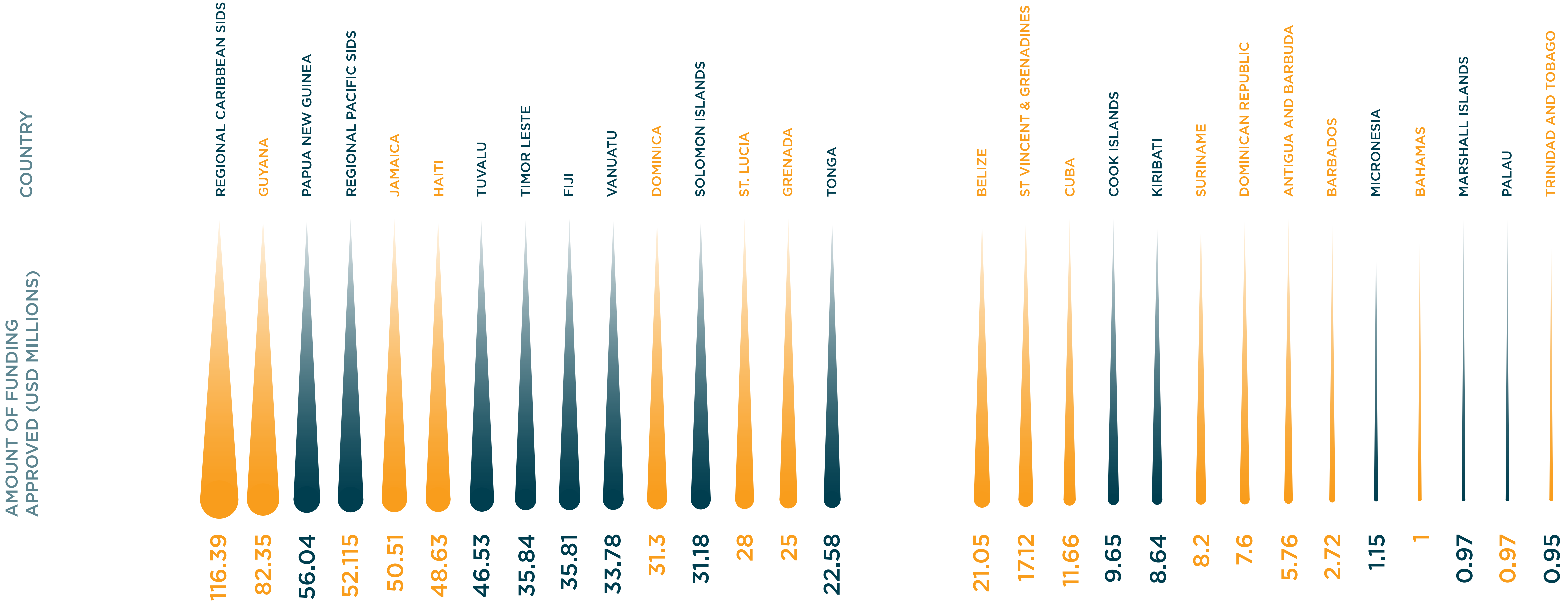
	SCCF	PPCR	PPCR	NICFI	GEF5	GEF4	GCCA	*IKI DEU	FCPF	CTF	AF
ANTIGUA AND BARBUDA	5.46										
BAHAMAS						1					
BARBADOS					1.72	1					
BELIZE	8						3.25		3.8		6
CUBA					5.5						6.07
DOMINICA		21			1.72						
DOMINICAN REPUBLIC				1.72	1.72			2.24	3.8		
GRENADA		21						6.30			
GUYANA	3.8		65.9		5		3.75		3.8		
HAITI		17.5		6.42		1.97	6.73			16	
JAMAICA	0.75				2.1	1.97	4.63				9.97
ST. VINCENT & GRENADINE		15			1.7			0.40			
ST. LUCIA		27			1						
SURINAME					4.4				3.8		
TRINIDAD AND TOBAGO				0.92							

*IKI DEU : GERMANY'S INTERNATIONAL CLIMATE INITIATIVE
*IKI GBR : UNITED KINGDOM'S INTERNATIONAL CLIMATE INITIATIVE

Source: Climate Funds Update, http://www.climatefundsupdate.org/

FUNDS DATA

This data was included as additional information and as a consultation tool

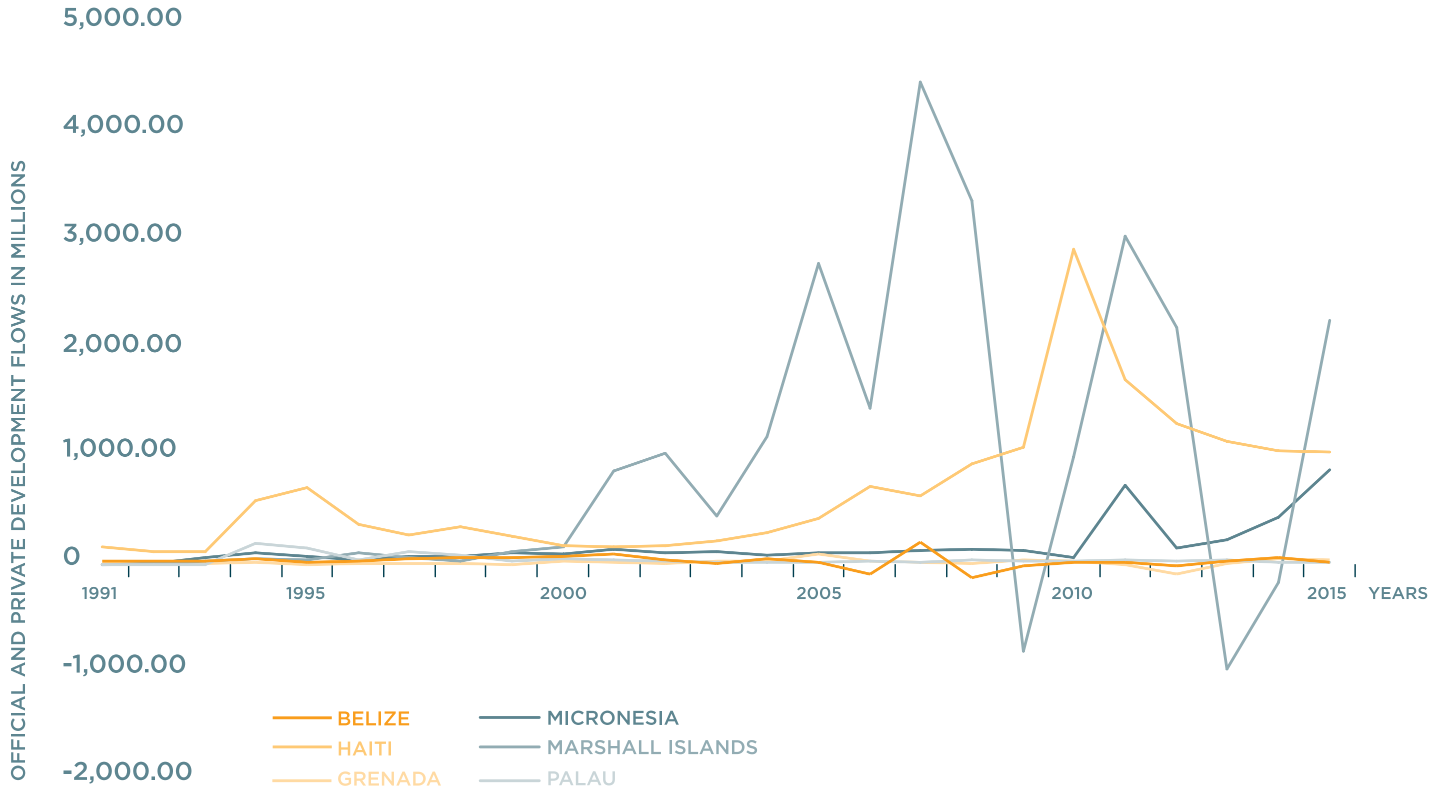


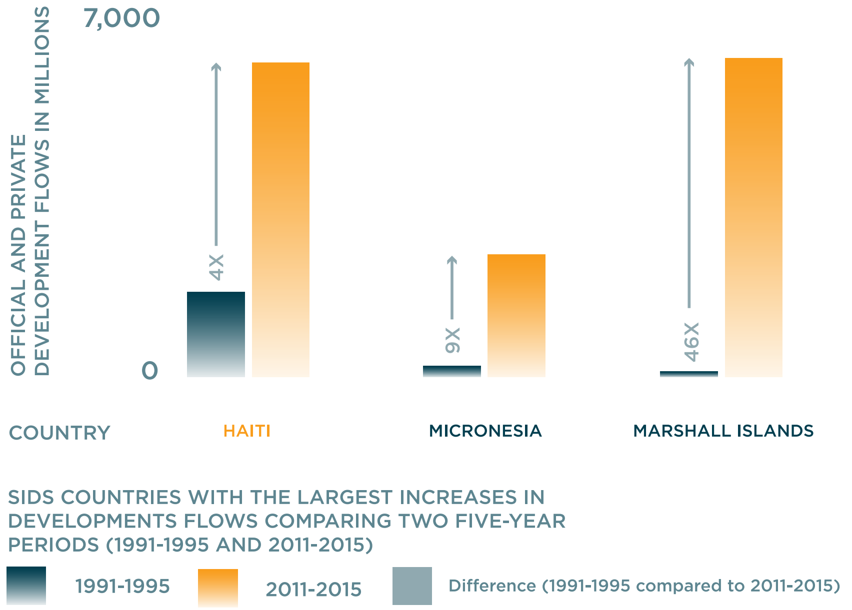
TOTAL CARIBBEAN SIDS **458.26**

TOTAL PACIFIC SIDS **335.32**

GRAND TOTAL **793.58**

NOTE: THIS INCLUDES MULTILATERAL AND BILATERAL CLIMATE FUNDS





SIDS COUNTRIES WITH THE LARGEST INCREASES IN DEVELOPMENTS FLOWS COMPARING TWO FIVE-YEAR PERIODS (1991-1995 AND 2011-2015)

Source: OECD (2017) Total receipts by country and region (ODA+OOF+private), OECD.Stat, https://stats.oecd.org.

SIDS should have a full understanding of how to access international climate finance, especially the Green Climate Fund. However, a critical component of improving access to international adaptation financing is improving readiness (Robinson and Dornan, 2016). Readiness is not only the ability to adapt but also to receive and manage funds and other resources for adaptation. SIDS need to become ready by first gaining a greater understanding of access modalities and how to navigate the international financial system (Robinson and Dornan, 2016).

The Paris Agreement was a landmark consensus on the need to finance adaptation to climate change. Under the Paris Agreement—agreed on by 195 UN member states in December 2015—countries agreed to make finance flows consistent with a pathway toward low GHG emissions and climate-resilient development. Developing countries are to receive financial resources for both mitigation and adaptation, while developed countries are expected to continue to lead in mobilising climate financing from a variety of sources, with public funds playing a significant role in reaching the previously agreed US$100 billion annual target by 2020. Monthly Climate Finance Updates aim to help track multilateral financing to support the finance goal agreed to under the United Nations Framework Convention on Climate Change. This will in turn contribute to implementing SDG 13—take urgent action to combat climate change and its impacts.

It has been argued that development assistance can be better targeted if reconciled with bottom-up, locally based planning processes that take climate risks into account and programmes that aim to be mainstreamed into urban development over time (Brugmann, 2012). Research shows the lack of well-defined priorities in partner countries, combined with a donor tendency to control funds for short-term results and a large variety of different funding instruments, result in fragmented delivery systems and unclear outcomes (Brown and Peskett, 2011). Even where climate strategies exist to guide action, the plan is often neither costed nor sequenced, making it an inadequate framework to deliver financing (Hedger, 2011). Donor agencies play a pivotal role in providing technical cooperation to SIDS to prioritise their adaptation projects and then submit requests for green finance funding. Smaller SIDS, however, could benefit from training in social and economic cost–benefit analysis and the application of evaluation tools to first identify priority actions to target adaptation funds.

A number of authors have concluded that international development financing is failing to tackle urban adaptation financing needs (Parry, Arnell, Berry, et al., 2009; Paulais and Pigey, 2010; ICLEI, 2011; UN-Habitat, 2011c). National governments could establish funds supported by international financing (governmental, philanthropic, or both) and on which urban governments and community-based organisations could draw (Paulais and Pigey, 2010; Satterthwaite and Mitlin, 2014). A more effective and sustainable strategy than a focus on external funding may be national policy reforms and incentives to steer investment to priority needs (Brown and Peskett, 2011). There is also a need to mobilise domestic public and private investment to ensure adaptation at national and urban levels (Hedger, 2011; Hedger and Bird, 2011; OECD, 2012). Accessing all these sources of development financing for urban adaptation will require institutional mechanisms to support multi-level planning and risk governance (Carmin et al., 2013).

Special funds are necessary for investments to enhance the resilience capacity of SIDS coastal cities. As Meyer and Peters (2016) suggested, these investments should be considered pre-investments that will lead to greater benefits in the long term. The main priorities should be long-term strategies and smart combinations of climate change adaptation measures. Long-term strategies could be resilience-enhancing investments that can grow incrementally. This could start with relatively small investments that would generate new tax revenue, which would then allow public authorities to increase public investments in the next round. Some examples exist in SIDS where this course of action is being pursued. The IDB (2011) financed coastal management in Barbados to build resilience to coastal hazards along the western and south-western coastlines of the island. The Australian Government and the Commonwealth Secretariat (2015–20) are assisting cities in Antigua and Barbuda, Dominica, Guyana, Jamaica, and St. Kitts and Nevis to cope with the impacts of climate change by helping them access funds from a global fund totalling US$100 billion per annum that is available up to 2020.

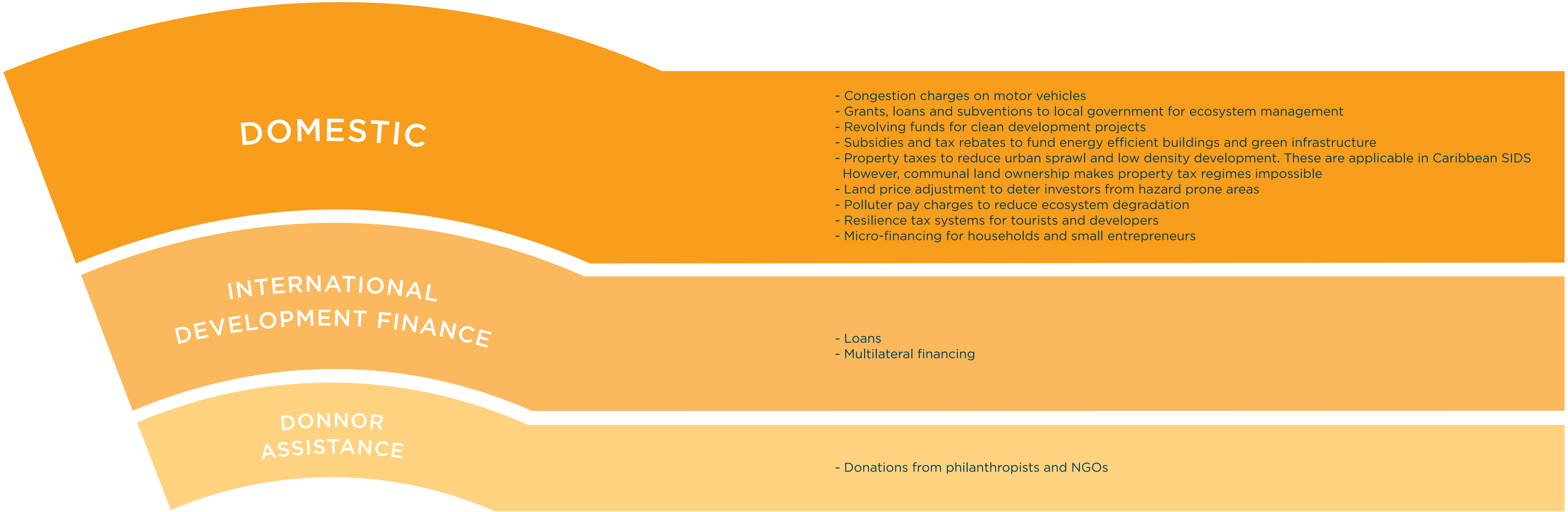
Another potential financing mechanism is introducing smart combinations of resilience tax systems for travellers, tourists, and developers in SIDS, as well as environmental impact taxes imposed on developers that, for example, contribute to flooding. This approach has been adopted in Castries, Saint Lucia, where the World Bank (2014) funded improving insurance mechanisms and climate change financing for long-term recovery and building resilience against flooding and landslides.

Table 6.3 provides a summary of levels of financing and the various instruments that may be applied to finance climate change adaptation in SIDS.

FIGURE 6.3

SUMMARY OF LEVELS OF FINANCING AND EXAMPLES OF FINANCING INSTRUMENTS FOR SIDS

Source: Authors.



DOMESTIC

- Congestion charges on motor vehicles
- Grants, loans and subventions to local government for ecosystem management
- Revolving funds for clean development projects
- Subsidies and tax rebates to fund energy efficient buildings and green infrastructure
- Property taxes to reduce urban sprawl and low density development. These are applicable in Caribbean SIDS However, communal land ownership makes property tax regimes impossible
- Land price adjustment to deter investors from hazard prone areas
- Polluter pay charges to reduce ecosystem degradation
- Resilience tax systems for tourists and developers
- Micro-financing for households and small entrepreneurs

INTERNATIONAL DEVELOPMENT FINANCE

- Loans
- Multilateral financing

DONNOR ASSISTANCE

- Donations from philanthropists and NGOs

6.14.3

MICRO-FINANCING

SIDS have been quite innovative in using micro-financing to assist small farmers and businesses. Climate change adaptation in SIDS cities may benefit from micro-finance schemes customised for the poor. Instruments could include micro-credit, micro-insurance, and micro-savings to lend assistance to urban households and micro-enterprises that have been marginalised from formal insurance and commercial credit markets (see Box 6.1).

BOX 6.1

MICRO-FINANCING FOR URBAN ADAPTATION

Micro-finance schemes could contribute to pro-poor, urban adaptation through a variety of different instruments, including micro-credit, micro-insurance, and micro-savings to help households and small entrepreneurs that do not have access to formal insurance or commercial credit markets. Such schemes have been applied mostly in rural areas, usually benefitting those with some property (and thus not the poorest of rural populations). As Hammill, Matthew, and McCarter (2008, p.117) state: “The value [a micro-finance scheme] holds for climate change adaptation is in its outreach to vulnerable populations through a combination of direct and indirect financial support, and through the long-term nature of its services that help families build assets and coping mechanisms over time, especially through savings and increasingly through micro-insurance—products and sharing of knowledge and information to influence behaviours.” These are more costly than commercial loans, but micro-finance has benefits:

- Can support entrepreneurial undertakings by those unable to access bank loans.
- Helps diversify local economies.
- Empowers women in particular, which can in turn contribute to adaptive capacity in a local context. (Agrawala and Carraro, 2010; Moser, 2010).

Micro-finance also provides a means for donors to deliver support to low-income groups without creating an ongoing dependence on aid. But it is important to target micro-financing to avoid encouraging growth in areas prone to climate risk (Hammill et al., 2008; Agrawala and Carraro, 2010). A limitation of micro-financing for adaptation is that it typically provides credit to individuals, so it is not easily used to finance collective investments—for instance, improving drainage—and it can be a route to indebtedness during disaster recovery. There has been some experience of pooling savings. For example, in Asia, low-income communities set up City Development Funds from which they can draw loans for disaster rehabilitation, among other needs (Archer, 2012). Von Ritter and Black-Layne (2013) explored the possible role of micro-financing and crowd-funding to support local climate change action, such as financing small decentralised energy solutions or climate-proofing homes. They also suggested the new Green Climate Fund could support such activity through its private sector window.

TABLE 6.1

SUMMARY OF POLICY RECOMMENDATIONS FOR SIDS COASTAL CITY ADAPTATION AND RESILIENCE

Source: Authors.

Policies	Recommendations
Use multi-prong approach	• Use mix of protective, accommodation, and retreat adaptations for short-and long term • Avoid standalone measures • Avoid relocation • Integrate formal and informal actions • Recognise informal settlements
Use integrated planning	• Adopt integrated planning instead of uni-sectoral planning • Work across sectors at varying scales and with different governance levels • Promote ICZM, including watersheds and coastal ecosystems
Use sustainable planning and city form	• Adopt realistic policies • Strengthen implementation capacity • Revise land use zoning, building codes, and infrastructure standards to adapt to climate change • Conduct city resilience profile • Use coastal setbacks as part of managed retreat from coastlines • Control urban sprawl and promote compact urban form using infilling and mixed use zoning
Adapt housing and informal settlements	• Incorporate risk reduction into the location and design of social housing • Structurally retrofit poor-quality housing • Increase resilience of coastal housing using building codes
Adapt urban water supply	• Implement water pricing policy • Promote rainwater harvesting and recycling where coastal aquifers have been damaged • Reuse grey water • Educate consumers • Promote water technology to reduce consumption and wastage
Build climate-resilient coastal infrastructure	• Strengthen coastal defences to protect coastal infrastructure (e.g., roads, airports, ports) • Realign or relocate highways located in highly vulnerable locations
Promote EBA and green infrastructure	• Use EBAs (e.g., wetlands, watershed management, and coral reef restoration) to protect urban areas • Use green infrastructure in managing storm water
Prioritise investments	• Prioritise investments using national public investment system and cost–benefit analysis

TABLE 6.1
CONTINUATION

Policies	Recommendations
Improve readiness to access and use financing	• Improve readiness to access, receive, and use international funding • Train personnel to navigate the international financial system
Integrate climate change, disaster risk reduction, poverty reduction, and city resiliency	• Promote use of disaster risk reduction policies in urban plans • Integrate coastal zone planning and management in urban policies and plans • Promote climate change adaptation to reduce urban poverty
Building institutional capacity	• Build and retool capacity of locals to adopt innovative technologies and mainstream urban planning adaptation and disaster risk reduction into planning coastal cities • Conduct regional training workshops in climate change adaptation and disaster risk reduction and use of fiscal tools to mobilise funds domestically to implement projects • Strengthen capacity of local governments in adaptation planning, implementation, monitoring, and evaluation
Strengthening capacity to acquire local data and build SIDS information systems	• Encourage use of new technologies for data acquisition (e.g., geographical information systems, airborne laser scanning, LandStat)
Developing metrics to measure success of city adaptations	• Develop indicators to measure demographic characteristics, housing, and building quality; impact on infrastructure, services, ecosystems, financial losses, and coping capacity of individuals, households, and communities; and need for external assistance
Monitoring and evaluating city adaptation	• Develop adaptive index to determine risks and adaptation options at the city level • Train to monitor and evaluate projects
Engaging stakeholders	• Understand concerns and interests of stakeholders • Explain project merits to local community and manage expectations • Encourage stakeholder ownership
Building urban governance	• Promote well-functioning multi-level urban governance • Facilitate engagement of urban government, households, communities, private sector, universities, research institutions, and professional organisations
Creating policies, laws, and guidelines	• Embed climate change adaptation policies in laws, regulations, standards, and guidelines to promote enforcement
Providing rewards and incentives	• Promote use of incentives to improve compliance with climate change adaptation policies
Coordinating projects	• Coordinate projects to avoid duplication of effort in a resource constrained environment
Financing city adaptation	• Tap into national and subnational regional sources of funding • Use market instruments to mobilise financial resources • Tap into Green Climate Fund • Explore micro-financing, especially to assist poor urban households

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NASSAU 2015

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A FUTURE AGENDA FOR SIDS

> We reaffirm that small island developing States remain a special case for sustainable development in view of their unique and particular vulnerabilities and that they remain constrained in meeting their goals in all three dimensions of sustainable development. We recognize the ownership and leadership of small island developing States in overcoming some of these challenges, but stress that in the absence of international cooperation, success will remain difficult....We call for an increase in all forms of partnership with and for small island developing States....We reaffirm that small island developing States are equal partners and that empowered, genuine and durable partnerships are based on mutual collaboration and ownership...

SIDS Accelerated Modalities of Actions
(SAMOA Pathway) resolution

For all SIDS, a future agenda is fundamental to adapt to climate change and to build resiliency in coastal cities. The challenge facing government officials is investing in protection before the damage occurs. It is imperative that SIDS prioritise investments in building resiliency, otherwise projects will be deferred and may never be implemented. International and regional cooperation is required to support sustainable urban development efforts in SIDS given their limited technological resources and expertise and the tremendous cost involved in reducing the high vulnerability of their coastal cities to climate change.

A future urban agenda for SIDS countries and local authorities will entail a twinning of the SIDS agenda with the broader SDG and New Urban Agenda. The recent "Implementing the 2030 Agenda for Sustainable Development in Small Island Developing States (SIDS)" Conference sponsored by the Government of The Bahamas, with the support of the UN DESA, suggests a direction for action. It called for SIDS to operationalise the SDGs of the 2030 Agenda and the SAMOA Pathway into their national planning processes, policies, strategies, and public institutions, along with other recent UN agreements, such as the Sendai Framework for Disaster Risk Reduction, the Addis Ababa Action Agenda on financing for development, the Paris Agreement on climate change, and the New Urban Agenda. SIDS will need to take at least four concrete actions, as specified by the SAMOA Pathway,

1. build resilience to the impacts of climate change and to improve their adaptive capacity through the design and implementation of climate change adaptation measures appropriate to their respective vulnerabilities and economic, environmental and social situations;
2. improve the baseline monitoring of island systems and the downscaling of climate model projections to enable better projections of the future impacts on small islands;
3. raise awareness and communicate climate change risks, including through public dialogue with local communities, to increase human and environmental resilience to the longer-term impacts of climate change; and
4. address remaining gaps in capacity for gaining access to and managing climate finance (United Nations General Assembly, 2014).

Urgent action is needed to achieve SDG 11 ("Make cities and human settlements inclusive, safe, resilient and sustainable") in the vulnerable coastal cities of SIDS. Habitat III, which convened in 2016, presented a unique opportunity to formulate a New Urban Agenda. Under the New Urban Agenda, the United Nations acknowledged the importance of the COP21 agreement and underscored the special circumstances of SIDS in relation to size, resources, and vulnerability to climate change and natural hazards. A commitment was made by member countries to facilitate urgent action to promote environmentally sustainable and resilient urban development in these small states. The need for a transformative Blue Urban Agenda for SIDS is clear and conditions are ripe. It is up to all leaders in government, business, the donor community, and civil society to galvanize efforts to adapt to climate change in coastal cities, improve housing and radically enhance quality of life in the region.

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Public, private and academic practitioners searching for ways to reimagine and apply 'place based' approaches to adaptation strategies in the small island context will find this a welcomed resource. It provides practical examples that respond to the COP21 and Habitat III commitments to climate change and is applicable to global work on energy-efficient and disaster-resistant housing. This book can serve as a critical resource for developing timely adaptation strategies in the battle to prevent a rising tide of massive forced relocation for vulnerable coastal populations in the forgotten SIDs context.

Steven Weir, VP Global Program Development,
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This book provides a well-illustrated text for urban planners, policy-makers, international development agencies, politicians and the interested public within Pacific SIDS. It is also a useful reference for postgraduate planning, geography, environmental studies and economics students. The commonality of climate change issues affecting Caribbean and Pacific SIDS makes the comparative examples utilized relevant - offering a wealth of insight into current practices in SIDS. Finally, this book is a strategic contribution to the challenge of adaptation and financing to climate change at the local and national level for Pacific SIDS. It proposes innovative adaptation measures for coastal cities in SIDS. This book is essential reading for professionals and policymakers involved in managing SIDS coastal cities.

Doni Wainiquolo, Department of Town and Country Planning, Fiji

A timely, relevant publication that provides a succinct update on the adaptation activities of Caribbean and Pacific SIDS in one volume. While it focuses on climate risks and adaptation in the main urban areas of these coastal states, the lessons learned and the adaptation guidance have significance beyond the coastal fringe and are equally applicable to other SIDS regions.

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This is a timely publication that reveals stark truths and necessary actions if we are to change the effects of climate change and other pressures on island nations. This research will serve as a guide towards greater island resilience and recovery even as threats increase and our island members search for solutions globally. It is our hope that such research, combined with innovative island-led interventions like the Island Resilience Initiative will combat these threats.

Stewart Sarkozy-Banoczy, Global Island
Partnership/Precovery Labs

Most of the literature on climate change provides information on the issues at the global, regional and national levels. Information on the actions being taken to address climate change at the sub-national or city level, especially in the Small Island Developing States (SIDS), is limited. Information provided in the Blue Urban Agenda is helping to fill this gap. It addresses the needs of a new audience in the region that may not otherwise be interested in climate change.

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