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HURRICANES RELOADED



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ABOUT ECLAC/CDCC

The Economic Commission for Latin America and the Caribbean (ECLAC) is one of five regional commissions of the United Nations Economic and Social Council (ECOSOC). It was established in 1948 to support Latin American governments in the economic and social development of that region. Subsequently, in 1966, the Commission (ECLA, at that time) established the subregional headquarters for the Caribbean in Port of Spain to serve all countries of the insular Caribbean, as well as Belize, Guyana and Suriname, making it the largest United Nations body in the subregion.

At its sixteenth session in 1975, the Commission agreed to create the Caribbean Development and Cooperation Committee (CDCC) as a permanent subsidiary body, which would function within the ECLA structure to promote development cooperation among Caribbean countries. Secretariat services to the CDCC would be provided by the subregional headquarters for the Caribbean. Nine years later, the Commission's widened role was officially acknowledged when the Economic Commission for Latin America (ECLA) modified its title to the Economic Commission for Latin America and the Caribbean (ECLAC).

Key Areas of Activity

The ECLAC subregional headquarters for the Caribbean (ECLAC/CDCC secretariat) functions as a subregional think-tank and facilitates increased contact and cooperation among its membership. Complementing the ECLAC/CDCC work programme framework, are the broader directives issued by the United Nations General Assembly when in session, which constitute the Organisation's mandate. At present, the overarching articulation of this mandate is the Millennium Declaration, which outlines the Millennium Development Goals.

Towards meeting these objectives, the Secretariat conducts research; provides technical advice to governments, upon request; organizes intergovernmental and expert group meetings; helps to formulate and articulate a regional perspective within global forums; and introduces global concerns at the regional and subregional levels.

Areas of specialization include trade, statistics, social development, science and technology, and sustainable development, while actual operational activities extend to economic and development planning, demography, economic surveys, assessment of the socio-economic impacts of natural disasters, climate change, data collection and analysis, training, and assistance with the management of national economies.

The ECLAC subregional headquarters for the Caribbean also functions as the Secretariat for coordinating the implementation of the Programme of Action for the Sustainable Development of Small Island Developing States. The scope of ECLAC/CDCC activities is documented in the wide range of publications produced by the subregional headquarters in Port of Spain.

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**DIRECTOR'S DESK:****HURRICANES RELOADED!**

The 2017 Atlantic Hurricane season has been one of the most severe on record, having generated as many as 10 hurricanes, of which at least three have reached category 4 status. Two of these storms, Irma and Maria, were category 5 and wreaked havoc in the Caribbean with severe impacts on many of the territories from the mid to north east of the Eastern Caribbean chain of islands.

While many governments and multilateral agencies, including ECLAC, are still busy assessing the economic, social and environmental costs of these disasters, the extreme metrics associated with the current hurricane season call for reflection and careful analysis of the Caribbean's current and future efforts to treat with the management and mitigation of these natural events.

The events have reaffirmed the vulnerability of Caribbean economies, but also exposed the challenges in humanitarian response and risk management capacity, as well as the weakness of systems of governance in the face of the impacts of these disasters.

In recognition of these challenges, this issue of the FOCUS magazine examines two broad thematic issues related to the status of disaster risk reduction in the Caribbean. The first

examines the role of financing and risk management in crafting an enhanced disaster risk management framework for Caribbean economies, and makes recommendations for the setting up of key institutional risk management structures, so that these may shore up the resilience capacity of our small island states.

The second issue is flooding and urbanization in the region, analysed through a case study of Port of Spain, the capital city of Trinidad and Tobago. As is now increasingly being recognized, a significant part of the impact of hurricanes in the sub-region is manifested in the form of excessive rainfall and related catastrophic flooding. The assessment presented in the case study points to the exacerbating effects of widespread urbanization - a rapidly developing phenomenon in the Caribbean - on the extreme flooding events that are becoming more common

place as a result of climate change.

In light of the unprecedented nature of the 2017 hurricane season, this issue of the Focus Magazine also takes the opportunity to recognise the manifest resilience of Caribbean people, so admirably demonstrated over the past months, as well as to salute the many national, regional and multilateral stakeholders, who have been generous in coming to the assistance of their neighbours, during their time of distress.

Yours in Focus

A handwritten signature in black ink, appearing to read 'Diane Quarless'.

Diane Quarless



FINANCING, FROM RESPONSE AND RECOVERY TO RISK MANAGEMENT

Leda Peralta Quesada

The World Bank estimates that a disaster can lower the GDP of a developing country by up to five per cent after it has struck (2016). This is aggravated by the fact that some of these countries – including Caribbean SIDS – are highly indebted. As a result, disasters increase financial burdens, weaken fiscal balances and divert funding from development programs. Borrowing requirements also increase for financing the reconstruction processes. In addition, disasters aggravate socioeconomic vulnerabilities, as it increases the demand for social programs and spending.

Addressing these issues requires strong institutional and regulatory frameworks that ensure an efficient and transparent collection and use of resources. Against this backdrop, this article discusses the issue of financing for disaster risk reduction.

It is important to note that underinvestment in disaster risk management and resilience building is a recurring issue caused, among others, by lack of financial resources, limited understanding of risks and vulnerabilities and their potential costs, and weak political commitment. Moreover, while international assistance might be available for post-disaster response, rehabilitation and reconstruction – which have greater political buy-in as activities are more visible – the same cannot be said for pre-disaster preparedness, which is characterized by an under-investment in Disaster Risk Reduction (DRR).

Between 1991 and 2010, an estimated US \$3.03 trillion were invested globally in development assistance, with disaster risk management accounting for approximately US \$106.7 billion. The distribution of the assistance shows the focus on ex-post spending, as only 12.8 per cent of the funds were used for disaster risk reduction, while 21.7 per cent were destined for reconstruction

and rehabilitation, and 65.5 per cent for emergency response (ODI, 2015). Similarly, an analysis of assistance for DRR suggests that 61 per cent of the projects focused on enhancing disaster preparedness for effective response, and on building back better in recovery, rehabilitation and reconstruction, followed by 14 per cent devoted to understanding disaster risk, and only 8 per cent was invested in DRR for resilience (ODI, 2015). However, it should be noted that, in countries where DRR is embedded into multisectoral planning and budgeting, there is an important challenge to measure and monitor DRR investments as they have become fully integrated, and attribution is more difficult.

Ex-ante investments in DRM have also been limited since *“the cost of DRM tends to dominate decisions because they are more immediate, concentrated, and observable, while the benefits are longer term, distributed more broadly and often less visible”* (ODI, GFDRR & WB, 2015). Consequently, this approach views DRM investments as sunk costs if disasters do not strike, without understanding the overarching social, economic and environmental benefits attached to risk-informed, multisectoral investments and projects. An integral DRM strategy should have positive effects in overall

poverty alleviation, fiscal stability, economic growth and sustainability of development programs. This highlights the importance of climate- and risk-informed projects, risk management, and financial protection in the form of risk financing and risk transfer.¹

This tendency has been slowly changing as countries learn from past experiences, acknowledge the role played by adequate financing, and recognize the overarching value of investing in each DRM pillar (risk identification, risk reduction, preparedness, financial protection and resilient reconstruction).

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¹ C The Organization for Economic Cooperation and Development (OECD, 2012), defines risk protection and risk transfer as follows:

“Risk financing involves the retention of risks combined with the adoption of an explicit financing strategy to ensure that adequate funds are available to meet financial needs should a disaster occur. Such financing can be established internally through the accumulation of funds set aside for future use or obtained externally through pre-arranged credit facilities. The banking sector, capital markets and international lending institutions are sources of risk financing.

Risk transfer involves the shifting of risks to others who, in exchange for a premium, provide compensation when a disaster occurs, ensuring that any financing gap that might emerge is partially or fully bridged. Risk transfer may be obtained through insurance policies or capital market instruments such as catastrophe bonds.”

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FINANCIAL PROTECTION

Comprehensive and integral financial protection strategies support governments' ability to manage shocks caused by disasters (or the effects of climate change), reduce budget volatility, improve planning and budgeting processes, set priorities and courses of action, and, in general, increase financial flexibility and protect development accomplishments.

Other benefits include transparency, efficiency in the use of resources, increased response capacity, financial discipline and risk layering. It should be noted that financial protection is only one component of a DRM strategy, so it must go hand-in-hand with disaster risk reduction programs, as they are mutually reinforcing. A combination of ex-ante and ex-post financing would support governments in managing the residual risk that is not mitigated through DRR efforts. In addition, and considering the strong link between DRM and climate change adaptation (CCA), disaster risk financing can increase resilience to climate variability and extreme weather events, and inform CCA investments. On the other hand, lack of resilience building could result in economic losses and inefficiency even before a disaster strikes.

In this scenario, specialized agencies consider that investments in disaster resilience can yield a triple dividend by *"(i) avoiding losses when disasters strike; (ii) unlocking development potential by stimulating innovation and bolstering economic activity in a context of reduced disaster-related background risk for investment; and (iii) through the synergies of the social, environment and economic co-benefits of disaster risk management investments even if a disaster does not happen for many years"* (ODI, GFDRR & WB, 2015). Complementarily, compartmentalized and stand-alone

DRR projects are no longer a sustainable practice, as planning and budgeting play a crucial role in putting comprehensive risk management measures at the core of national and global development agendas, so that disasters and the effects of climate change do not derail previous or future progress.

Risk assessments and the financial impacts of disasters need to be quantified and understood by ministries of finance in order for them to be included in financial, fiscal and investment strategies. Thus, ministries of finance play a vital role in establishing resilience-oriented financial strategies that combine investments in risk prevention and risk transfer, with resources for emergency response, recovery and reconstruction. Although DRM benefits from multisectoral collaboration, its agenda is usually fulfilled by specialized agencies. Therefore, the need for financial protection opens an opportunity for the incorporation of ministries of finance in the development of a resilient strategy that considers risks in public investments. These ministries can also contribute their expertise in fiscal and debt risk management, as well as their knowledge of the financial situation of governments. Additional aspects that require focus include compensation programs for vulnerable and affected populations, identification of uninsurable segments of the economy, transfer mechanisms to support local governments, and the encouragement of public and private risk reduction.

MECHANISMS FOR FINANCIAL PROTECTION

A well-designed financial strategy must be climate- and risk-informed, and consider ex-ante and ex-post measures to address the entire cycle of DRM,

from risk identification to resilient reconstruction.

Therefore, a well-designed strategy must be founded on sound risk assessments and cost-benefits analyses to ensure sufficient funding for DRM investments.² Thus, in order to determine the amount of resources that must be allocated in each phase of the strategy, it is crucial to assess the potential economic and fiscal impacts of disasters.

The Global Facility for Disaster Reductions and Recovery (GFDRR) has developed a three-tier risk layering model that could be used as a guiding framework for the design of national strategies. This framework relies on sound and reliable data, and on analyses of risks and exposure. In addition to providing a logical framework, the elaboration of a financial strategy requires organizing the system, and should result in improved planning and budgeting processes.

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² It should be noted that the agencies such as the Organization for Economic Cooperation and Development and the Global Facility for Disaster Reduction and Recovery have elaborated guidelines for the implementation of disaster risk financing strategies.

FINANCING, FROM RESPONSE AND RECOVERY TO RISK MANAGEMENT

DATA AS A BASIS FOR DISASTER RISK MANAGEMENT

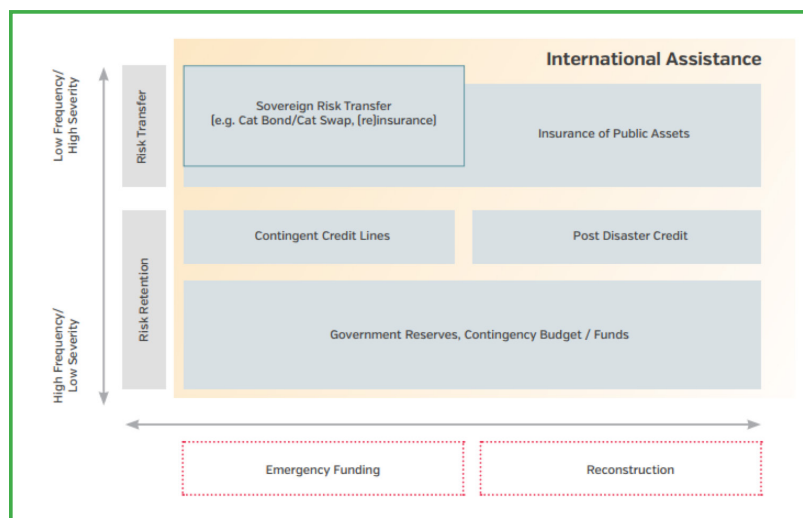
A well-designed financial strategy must be climate- and risk-informed, and consider ex-ante and ex-post measures to address the entire cycle of DRM, from risk identification to resilient reconstruction.

The region has advanced in its identification of risks and natural hazards. However, it is now necessary to go one step further and elaborate inventories of sectoral assets with emphasis on exposed infrastructure. By identifying exposed assets it is possible to design interventions to reduce the risk of disasters, elaborate projections of potential sectoral damage and losses, prioritize interventions in critically exposed sectors. This is especially the case for those that serve the general population, and improve the response. This information would provide evidence of exposed assets and potential financial vulnerability, which should inform financial strategies that respond to local conditions and needs.

It is important to identify and assess trends and possible underlying factors influencing vulnerability, such as economic development, urbanization, migration, technological change, and climate change.

In addition to improving information on exposure, it is also important to assess the effects and impacts of previous disasters. Disasters expose pre-existing social, economic and environmental vulnerabilities. These vulnerabilities should be used to guide public policy interventions to address the underlying issues that aggravate the risk of disaster. Post-disaster assessments also reveal weaknesses and strengths in the process of DRM, and provide opportunities to overcome identified deficiencies and

Figure 1: Three-tiered risk layering strategy



Source: GFDRR, WB & Swiss Confederation, 2014.

promote a resilient reconstruction. In this regard, the Caribbean Disaster Emergency Management Agency (CDEMA) has supported national emergency offices in the elaboration of initial Damage and Needs Assessments and in the provision of data-gathering. Similarly, the ECLAC Disaster Assessment Methodology – which is a multi-sectoral and standardized framework – supports government offices by providing the estimation of the effects and impacts of a disaster. Most recently, The Bahamas, Belize, Anguilla, Sint Maarten, Turks and Caicos, and the British Virgin Islands have made use of this methodology to assess the effects of disasters and to consider improvements for the reconstruction process. The standardized nature of the methodology promotes multi-sectoral evaluations, interoperability, and creation of local and/or national databases.

It should be noted that the assessment of disasters is proposed not only for large-scale events, but also high-frequency, low-intensity disasters, which have pervasive cumulative effects in local and national development.

The region also faces serious challenges in data production and sharing among

agencies. It is crucial to promote data sharing and the dissemination of information as it improves decision making and exposes lessons learned in past events.

INSTRUMENTS FOR FINANCIAL PROTECTION

It is important to reduce risks to a minimum before introducing financial measures. For example, high-frequency, low-intensity events could be financed through funds and contingent credits, while low-frequency, high-severity events could be addressed through market-based instruments, such as private insurance, insurance pools and parametric insurance.

The most relevant risk retention and risk transfer instruments include national funds, contingent credits and weather derivatives.

(a) National funds are sovereign disaster risk mechanisms that provide resources for emergency response, risk reduction, and reconstruction. However, it should be noted that each phase has specific requirements that should be addressed preferably through separate funds, or by establishing

particular disbursement guidelines for each one. Response funds would allow for expeditious resource allocation and execution during an emergency, while DRR funds would favor regular investments in resilience building, and reconstruction funds would reduce pressures on financial systems and increase their stability after an event. Given the context in which emergency and reconstruction funds are distributed, it is critical to establish disbursement and budget execution guidelines, as well as transparency and accountability measures to ensure the effective use of public funds.

(b) Contingent credits are secured in advance of a disaster and become available in case of an emergency. These credits provide immediate liquidity and interest rates are usually lower than traditional credit lines. The Inter-American Development Bank and the World Bank offer these instruments.

(c) Weather derivatives cover high-probability events. These financial protections are used to hedge against losses caused by abnormal or unexpected weather and meteorological conditions, such as temperature and rainfall. Unlike traditional insurance, weather derivatives are not based on demonstrated losses, and therefore, do not require extensive post-disaster analyses to trigger payments. They are parametric instruments based on weather indexes. As such, they require historic data to establish the required index, hence the importance of strengthening data collection and sharing schemes. Payments are triggered as soon as the pre-established index is altered.

The Global Index Insurance Facility supports the creation and growth of index-based insurance products for weather and disaster-related events. The objective of the facility is *“to expand the use of index insurance as a risk management tool in agriculture, food security, disaster risk reduction*

and access to finance”.³

Insurance offers different levels of coverage for national governments, households and productive sectors. At the national level, an important – and innovative – mechanism are risk insurance pools. Through CCRIF SPC, the Caribbean has become a frontrunner in this option for risk transfer. “CCRIF (SPC) is a first-of-its-kind government risk-sharing platform, aimed at assisting members to manage part of their catastrophe risk exposure through access to affordable and effective insurance coverage against disasters” (GFDRR, WB & Swiss Confederation, 2014). As a parametric instrument, CCRIF SPC relies on national data to elaborate country profiles, and payouts are disbursed within two weeks after the disaster.

In general, promoting an insurance culture would protect investments, improve data-based decision making, and promote the elaboration of models and maps of exposure. Additionally, it would sensitize the population on the potential damage and losses faced in the absence of financial protections, address tendencies of under-insurance, and would increase the security of investments, which should boost private developments.

Evidently, these instruments must be supported by national and subnational strategies to alleviate pre-existing socioeconomic vulnerabilities (i.e. poverty and unemployment) and improve regulatory frameworks and practices (e.g. building codes and land use planning) in order to be truly sustainable and resilient. Risk assessments and post-disaster evaluations would provide information and evidence on these vulnerabilities and help prioritize areas of intervention.

PROTECTION OF PUBLIC INVESTMENTS

Countries that seek to mainstream disaster

risk management in their development policy must dedicate important efforts to include the subject in planning and budgeting processes.

It is recommended that any new investments in public infrastructure incorporate a multi-hazard component of disaster risk reduction. In addition to increasing the projects' resilience, this practice also promotes a better understanding of threats and risks, and exposes potential damage and losses. It should be noted that it is important to include maintenance and other costs to increase sustainability and resilience. Once the threats, risks and potential negative effects are understood and accounted for, it is then possible to introduce prospective, corrective and reactive measures to manage risks (MIDEPLAN, 2010). Some specific approaches in this regard are:

- **Prospective management**, which relates to preventative and/or anticipatory measures to reduce the creation of new vulnerabilities. Some elements included in this component are investment plans and land-use or zoning strategies.
- **Corrective management**, which refers to anticipatory measures to reduce existing vulnerabilities. Actions include relocation of communities, retrofitting of existing infrastructure, and education and community involvement.
- **Reactive management**, which offers alternatives to respond to the emergency and manage the effects of a disaster.

It is estimated that between 2015 and 2030, global infrastructure investments will reach approximately US\$6 trillion per year (ODI, 2015). This opens an important opportunity to improve the quality of the investments by incorporating DRM and Climate Change Adaptation (CCA) components, which in turn increase resilience and sustainable use of resources.

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³ (GFDRR, WB & Swiss Confederation, 2014). Since its inception in 2009, the Facility has issued more than 6,000,000 policies that have favored farmers, pastoralists and micro-entrepreneurs with US\$ 119 million.

FINANCING, FROM RESPONSE AND RECOVERY TO RISK MANAGEMENT

CLIMATE CHANGE AND OPPORTUNITIES FOR MULTISECTORAL PLANNING

A well-designed financial strategy must be climate- and risk-informed, and consider ex-ante and ex-post measures to address the entire cycle of DRM, from risk identification to resilient reconstruction.

The challenges posed by disasters and climate change severely threaten the development gains achieved by Caribbean SIDS, and further limit countries' investment capacity. However, they also offer an opportunity for improved investments and financial management through multi-purpose projects that foster development and resilience, and make efficient use of scarce resources. Although the agendas of both sectors have evolved independently, their goals and activities are complementary and tend to overlap, and climate change adaptation is a fundamental component of disaster risk reduction. In addition, the nature of both challenges calls for strong collaboration with other

sectors (water, energy, transportation, public infrastructure, agriculture, and planning, among others) to achieve widespread benefits and efficiently use resources. Prominent examples are healthy forests, coral reefs, wetlands and other ecosystems that reduce vulnerability to climate change and increase resilience to disasters by acting as a first line of defense. Investments to mitigate and adapt to climate change can also contribute to reducing climate-related disaster risk through early warning systems, coastal protection infrastructure, information systems for data generation and sharing, and environmental conservation.

In the region, several DRM plans highlight the importance of improving the quality of the environment as it offers protection against certain hazards. Healthy coral reefs and mangroves offer coastal protection, dissipate wave energy, and buffer against strong winds and storm surges, but are severely threatened by urbanization and the effects of climate change. On the other hand, CCA strategies often include hard measures, such as construction of

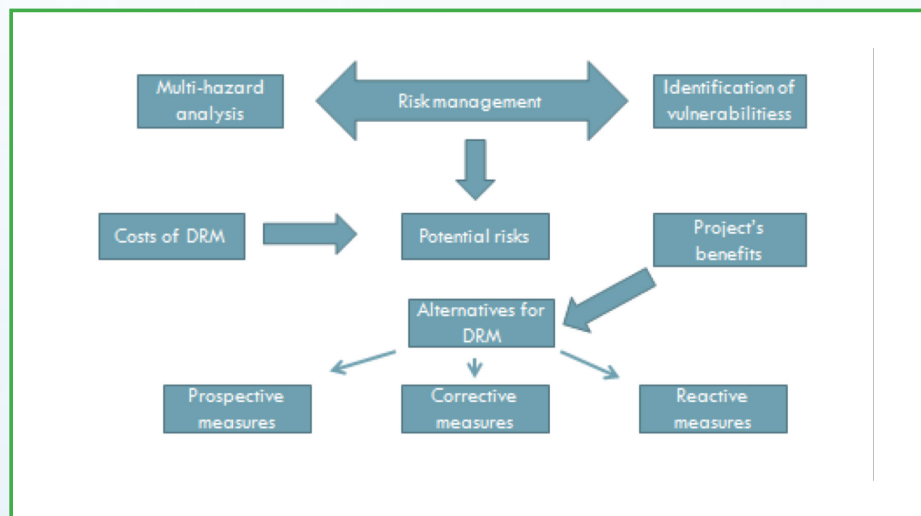
seawalls, dykes and elevation of critical infrastructure, all of which would favor disaster risk reduction. Similarly, both fields underscore the importance of implementing and enforcing sound land use plans, and diversifying national energy matrices as critical requirements to increase overall resilience.

Maintaining disaster risk reduction financing as a stand-alone area of activity rather than one that is integrated into development will always diminish its potential (ODI & UNDP 2014).

The international community has also begun to take advantage of disaster risk financing as part of CCA strategies (GFDRR, WB & Swiss Confederation, 2014). According to the Overseas Development Institute (ODI), between 2003 and 2014, US \$2.1 billion of concessional finance were devoted to climate change adaptation, of which US \$369 million were allocated to disaster risk reduction (DRR) activities. However, this value could be greater, as water management and agriculture programs also included DRR activities. It is estimated that in 2014, 43 per cent of adaptation finance included a DRR component (ODI, 2015).

Additionally, according to ECLAC, countries like The Bahamas and Jamaica have comprehensively incorporated DRM in their national development plans, and most countries have elaborated sectoral policies that address the issue to varying degrees. Perhaps one of the strongest links identified is between environment/climate change and disaster risk management. DRM policies in The Bahamas and Belize even recognize the importance of gathering

Figure 2: Incorporation of disaster risk management in public investments



Source: MIDEPLAN, 2010 (originally in Spanish, translated by the author).

data on the quality of the environment as it relates to the likelihood of disasters. Furthermore, some aspects of DRM have been considered in environmental impact studies, in particular the identification of natural hazards that may affect a given project, as well as the incorporation of mitigation measures to ensure its sustainability.

Research indicates that *“it remains the exception rather than the rule to integrate DRR and climate change approaches in the respective legal frameworks, where both areas are legislatively mandated”* (ODI & UNDP, 2014). An important obstacle in this regard is that responsibility for each field is usually placed in different institutions with separate budgets; climate change issues are usually overseen by the ministry of environment, while DRM is the responsibility of specialized agencies and/or the ministry of defense. However, this obstacle could be used as an opportunity by countries with limited institutional, technical and financial capacity that seek to strengthen inter-institutional collaboration, to make more efficient use of resources and improve their planning process. A shift from sector-focused projects is desirable to avoid silos, incentivize collaboration, and seek resilient investments, regardless of the funding/implementing sector.

The challenges posed by disasters and climate change in the Caribbean, and the momentum enjoyed by both fields, signal that international assistance and any new projects must be risk and climate sensitive in order to access the full range of development benefits and avoid unsustainable investments. The opportunities for collaboration abound, and are especially relevant considering national financial constraints and international assistance limitations.

Climate change and disasters share a resilience-building agenda that clearly

highlights the links between both fields but also with other sectors, such as land use and zoning, energy, water and wastewater management, transportation, health, and planning to name a few. Climate change, disasters and development are inextricably linked, causing unplanned climate change and disaster risks to seriously threaten development achievements, especially considering that disasters expose and exacerbate pre-existing vulnerabilities and inequalities, and disproportionately affect poor and marginalized populations. On the other hand, comprehensive planning processes that consider both issues are expected to be more efficient in the use of resources and to have multisectoral/overreaching societal benefits, as well as to be more sustainable and integrated with other sectors. In addition to improving collaboration and integration among sectors and institutions, this climate- and risk-sensitive approach would improve financing, and focus on supporting investments that make wider contributions to sustainable development. ■

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FLOODWATERS COME TO TOWN. NATURAL DISASTERS VULNERABILITY AND URBAN FLOODING – THE CASE OF TRINIDAD AND TOBAGO

Elizabeth Thorne

The Caribbean's vulnerability to disasters is well documented and is mainly due to geophysical and geological factors as well as to the subregion's ecological fragility. One such area of vulnerability is flooding, and urban flooding in particular.

In general, flooding events are devastating, and rank third among all global disasters (Udika, 2010). In the particular case of Trinidad and Tobago, its vulnerability to natural hazards is no different from that of its Caribbean neighbours. The country is the most southerly of the Caribbean islands, and is threatened by floods, earthquakes, tsunamis and hurricanes – although it is not in the direct path of major hurricanes. The capital city of Port of Spain is located on a low lying coastal plain on the north-western peninsular of the island, at the base of the Northern Range of mountains, and is plagued by urban flooding. Having been built in part on reclaimed land less than 1.5 m above sea level, the city's vulnerability to disasters has been exacerbated by its relatively high population density. According to the Central Statistical Office (CSO, 2011), Port of Spain is the most densely populated municipality in the country with roughly 3,090 persons/km².

The main contributing factors to flooding in Port of Spain are expanding urbanization; improper land use practices; an out-dated drainage system; uncontrolled disposal of solid waste; uncontrolled housing development; poor agricultural activities. Other factors are deforestation of the surrounding mountains; climate change; increased rainfall intensity; and increase in built areas; to name a few. Given the multifaceted nature of the city's flooding problem, it is anticipated that if it is not urgently addressed, the economic, social and environmental costs will prove to be a tremendous burden on the country in the future. The resolution of the problem therefore requires a holistic

strategy. The shaping of such strategy however requires a closer examination of the root causes.

EXPLORING THE CAUSES OF FLOODING IN THE CITY

The challenges posed by urbanization in the Caribbean are an old issue that has steadily worsened over the years (Udika 2010, Potter, 1995). In 2000, the United Nations pointed out that 70 per cent of the Caribbean's population resides in its capitals (UN 2014), thus making the region the most urbanized area in the world (Porter 1995).

Like other Caribbean capitals, the city of Port of Spain (POS) emerged out of a colonial past, with the city's activities revolving around support to the metropole through trade in monoculture agricultural commodities. These activities had numerous negative impacts on the colony, including the stimulation of mass migration of rural inhabitants into the city during the 1940s and 1950s. This trend continued until the 'oil boom' of the 1970s when the cost of city housing escalated. This resulted in an easterly shift of housing settlements from the POS city centre (Udika 2010). Initially, these began as loose developments arranged along the transportation route of the East-West corridors, primarily due to accessibility and affordability of housing. Eventually, these housing developments became more established, resulting in POS losing its status as the central residential area. At the same time, a high incidence of squatting communities emerged, juxtaposed to the wealthy in the surrounding Northern Range. Unfortunately, the onset of the 1980s

recession constrained the government from investing in the necessary infrastructure to support the urban spread, with the result that much of the current infrastructure is now incapable of dealing with the increasing wastewater load. This deficiency is one of the factors which currently manifest itself in the form of recurrent flooding events in the capital.

The effects of urbanization also extend into improper land use, in the form of improper housing practices, poor agricultural practices (slash and burn) and deforestation especially in the Northern Range watershed. These activities have devastating downstream impacts such as soil degradation, sheet erosion (during heavy rainfall), and compromised water quality and quantity which ultimately affect conservation of the watershed.

The city of POS is also saddled with out-dated drainage systems including storm drainage infrastructure which are in need of urgent upgrading. These are out of step with the increasing level of urbanization, thus compromising the integrity of these systems under the strain of torrential rainfall, and leading to increased surface run-off loads, reduced infiltration, lower aquifer levels, and interrupted natural aquifer and groundwater recharge processes (IDB, 2013).

Uncontrolled solid waste disposal throughout the city's streets and waterways is another factor which readily contributes to flooding in POS, as the streets are regularly littered with garbage as people and businesses discard their waste indiscriminately. This blocks the natural waterways in

the city which – when combined with similar circumstances in the upper catchment areas around the city – often results in further devastation through frequent flash flooding throughout the city.

All of the above are ultimately exacerbated by climate change, as the effects of rising sea levels, coastal erosion, and extreme weather events become more apparent throughout Caribbean Small Island States (SIDS). But what has been the response of Trinidad and Tobago to the flooding challenge in its capital to date? The following section will address this question.

THE RESPONSE OF THE GOVERNMENT OF TRINIDAD AND TOBAGO

While several past initiatives have been undertaken by the government to address the problem of flooding in POS, none have yielded any significant results.

Two recent initiatives under consideration are the “*Flood Alleviation and Drainage Program*” (FAP) and the Emerging and Sustainable Cities Initiative (ESCI). Both actions involve a collaborative arrangement between the Government and the Inter-American Development Bank (IDB). The FAP was focused on upgrading Port of Spain’s urban drainage and was designed to deliver improvement in the following ways:

- Updating the drainage infrastructure within the sub-catchment area between the St. Ann’s and Maraval rivers.
- Improvement of the population’s mobility specifically along the 1.4km linear park stretching from Belmont Circular Road to South Quay.
- Institutional strengthening of the Drainage Division of the Ministry of the Environment and Water Resources as strategy to ensure all are abreast with

cutting edge knowledge to advance the development and transformation of the city of Port of Spain.

This project was a push-back to advancing urbanization and perennial flooding plaguing the city’s inhabitants and transient population who must traverse the city daily, as well as home owners and business people who suffer financial losses due to flooding events. With respect to the ESCI, Trinidad and Tobago was selected to join the larger Latin America and the Caribbean (LAC) community in exploring the possibility of restoring its capitals through the ESCI concept. Under this initiative, the IDB and the representative governments work together to steer these cities towards economic, social and environmental sustainability as a unit and a “living network”. The ESCI involves the development and implementation of a Sustainable Action Plan to transform these capitals into sustainable cities. These policies are geared towards implementing flood and wastewater reuse strategies in order to assist in alleviating flood waters in Port of Spain.

POTENTIAL SOLUTIONS/TOOLS TO ARREST FLOODING

The above initiatives notwithstanding, there has also been exploration of sustainable solutions to address urban flooding within the urban development fraternity based on new approaches to urban planning and development.

Given the evidence of the direct correlation between increased urbanization and consequent flooding, it is critical for urban planners and government officials to understand the multi-dimensional nature of urban flooding and embrace a cross disciplinary response. Since traditional urbanization has effectively divorced man from nature (Gomez-Baggethun and Barton, 2013), this is an effort that seeks to connect remnant green spaces with the city boundaries as part of the rehabilitation of these systems so they

can continue to support life within the city.

There are also less intrusive interventions than the “hard” engineering structures that are in keeping with the urban ecosystem concept. Moreover, the application of Geoinformatics offers robust investigative opportunities to identify appropriate and effective responses that strengthen flooding relief. The Geoinformatics (GIS) interface can utilize various data from different sources for example: land use information, administrative boundaries, development pressure, and environmental constraints to examine threats, and define solutions that can contribute to flood management. However, the downside of GIS application in the Caribbean is the scarcity of relevant data to take maximum advantage of the potential of this tool in urban flood management. For example, there is currently no disaggregated GIS data for the Maraval and St. Ann’s areas, making it challenging to map the full scenario for POS. Nevertheless, at the national level the Trinidad and Tobago Office for Disaster Preparedness and Management has generated hazard, flood multi-risk and flood susceptibility maps that are valuable and can inform flood alleviation and water resources management in the country.

► (continued on page 12)

FLOODWATERS COME TO TOWN. NATURAL DISASTERS VULNERABILITY AND URBAN FLOODING – THE CASE OF TRINIDAD AND TOBAGO

CONCLUSION

There is strong evidence to show that Port of Spain displays the classic signs of urban flooding. The past collaboration between the GOTT and the IDB which involved tackling the problem through the implementation of the FAP and Trinidad and Tobago's involvement in the ESCI were initiatives aimed at transforming POS into a sustainable city.

There may be real value in exploring sustainable solutions to flood alleviation in POS. The proposed linear park in the IDB Sustainable Action Plan for Port of Spain is an example of the utilizing green infrastructure as a flood alleviation strategy. The changing paradigm as examined previously could be attributed to the failure of traditional infrastructure to accommodate the volume and power of storm waters within the urban space. Therefore, the introduction of the urban environment or ecosystem is essential to the transition to a holistic and more appropriate strategy. The rehabilitation and connecting of existing green spaces should be considered as a mechanism to increase infiltration and aquifer recharge. The commitment of policy makers is important to discover natural solutions for example: rainwater harvesting, green roof tops and many others. These green infrastructure efforts could reboot aquifer recharge and when strategically placed, may slow the rapid flood waters that invade the city street during the rainy season.

Ultimately, the intended transition of POS is a reasonable beginning to the implementation of the Sustainable Development Goals 11 – Sustainable Cities and Communities and Goal 6 Clean Water and Sanitation. It is also relevant to Goal 13 – Climate Action. ■

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