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ECLAC SUBREGIONAL HEADQUARTERS FOR THE CARIBBEAN

# FOCUS

Magazine of the Caribbean Development and Cooperation Committee (CDCC)

## IRMA AND MARIA BY NUMBERS

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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: IRMA AND MARIA BY NUMBERS

The 2017 Atlantic Hurricane season was one of the most impactful ones for the Caribbean subregion in recent years. The season's impact exceeded most of the customary physical indicators by which the strength, and social displacement of a hurricane are measured.

**S**torms, such as the 2017 hurricane season shows, are the most important natural hazard affecting the Caribbean countries. The decade average for Caribbean countries of the number of disasters and number of countries affected, and of the magnitude of the damage caused by storms has increased since the seventies. In terms of the aforementioned variables, the hurricane season of 2017 has been the third worst in history.

In this issue of the Focus magazine, based on preliminary findings of ECLAC's Damage and Loss Assessments, we present the economic effects and impacts in five of the countries that were affected by the two most powerful storm systems of the year – Hurricanes Irma and Maria. These assessments were conducted for Anguilla, The Bahamas, British Virgin Islands (BVI), Sint Maarten, and Turks and Caicos Islands (TCI) during the final quarter of 2017. The effects and impacts were assessed in terms of physical damage, losses of economic incomes and social services, plus additional costs.

The total estimated cost of the evaluations in these countries was approximately US \$5.4 billion. The most affected sectors were tourism and housing in that order. Given the size of these economies, this cost is

monumental. We estimate that the consequences of these events in Anguilla, British Virgin Islands and Sint Maarten will last several years. It is also important to note that the Bahamas has been hit by hurricanes the past three years in a row.

Consider, too, that the hurricane season 2017 has regional effects that have not yet been measured. For example, in the case of the tourism sector, it is likely that there was a decline in tourism across the entire region, including the unaffected countries between October and November 2017. Similarly, the substitution of tourist destinations could temporarily have taken place within the region given the destruction of tourism infrastructure in the countries directly impacted by hurricanes Irma and Maria.

The consequences of the 2017 Atlantic Hurricane season underscores the importance to the region of the key provisions of the Sendai Framework, especially investing in disaster risk reduction for resilience and enhancing disaster preparedness for effective response and the imperative of “Building Back Better” during recovery, rehabilitation and reconstruction.

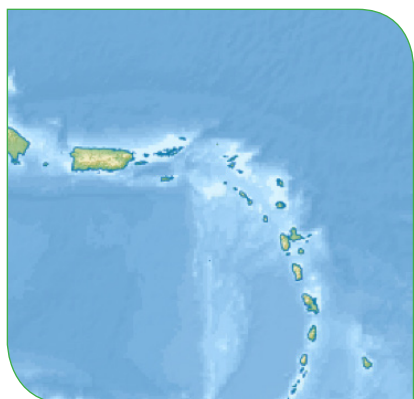
Finally, with respect to the disaster caused in countries of the region, it is important to recognize the

performance of a regional institution such as CDEMA and also the solidarity of unaffected Caribbean countries, whose citizens and governments made donations in kind and even gave refuge to people affected by these catastrophes.

The estimated numbers present but a cursory analysis of the consequences of disasters to our regional economies. Not fully measurable in this analysis, is the emotional and psychological impact of these disasters, the natural resource costs as well as the sunken opportunity costs to the region's development. Nevertheless, these numbers should serve to strengthen our resolve to undertake more rigorous disaster risk reduction strategies in order to better mitigate the impacts of these crises and to support a climate resilient region. As we approach another hurricane season, it is my hope that we are learning to build better and are more prepared as we seek to create a climate resilient region.

Yours in Focus

Diane Quarless



# EFFECTS AND IMPACTS OF HURRICANE IRMA IN ANGUILLA<sup>1</sup>

Omar Bello

Anguilla, a low-lying British Overseas Territory in the eastern Caribbean, was one of several islands subjected to the brutality of Hurricane Irma during the Atlantic Hurricane Season of 2017. After devastating Barbuda, the Category Five system made landfall in Anguilla and Sint Maarten on September 6th. That day by 8:00AM, the National Emergency Operating Centre reported that Hurricane Irma was located 15 miles west-southwest of Anguilla and moving west-northwest, with maximum sustained winds of 185 mph and higher gusts. At that time, the eye of Hurricane Irma was passing over Saint Martin and the northern eyewall was pounding Anguilla. A flash flood warning remained in effect in Anguilla until 12:00PM Wednesday September 6.

**A**nguilla, a low-lying British Overseas Territory in the eastern Caribbean, was one of several islands subjected to the brutality of Hurricane Irma during the Atlantic Hurricane Season of 2017. After devastating Barbuda, the Category Five system made landfall in Anguilla and Sint Maarten on September 6th. That day by 8:00AM, the National Emergency Operating Centre reported that Hurricane Irma was located 15 miles west-southwest of Anguilla and moving west-northwest, with maximum sustained winds of 185 mph and higher gusts. At that time, the eye of Hurricane Irma was passing over Saint Martin and the northern eyewall was pounding Anguilla. A flash flood warning remained in effect in Anguilla until 12:00PM Wednesday September 6.

Hurricane Irma caused few major injuries and one (1) fatality. With final preparations in place, an overwhelming majority of the population opted to weather the storm in private accommodations, with only 12 of the

island's 13,572 residents electing to utilize public shelters. Three of the four shelters were compromised. Fortunately, none of their occupants required hospitalization, evacuation or relocation in the immediate aftermath.

The country sustained significant damages to its environment and economy, resulting in major disruptions to Anguilla's private productive and tourism sectors. Of the total damages estimated at Eastern Caribbean Dollar (XCD) 507 million, 76.5 per cent was incurred in the private sector and 23.5 per cent in the public sector. A sectoral analysis revealed that the productive sector was hardest hit, accounting for 54.8 per cent of damages; followed by the social and infrastructure sectors which stand at 28.2 per cent and 17 per cent respectively.

Losses were valued at XCD 331.5 million. Further evaluations of these estimates indicate that the most affected sectors were the productive (85.1 per cent), infrastructure (12.5 per cent), and

social sectors (2.4 per cent). Again, the private sector was more impacted than the public, representing 88.3 per cent and 11.7 per cent of total losses.

The public sector will have to bear the majority of additional costs, assuming 58.2 per cent of the total expenditure estimated at XCD 41.9 Million. The previous trend continues, as most funds will be expended in the productive, infrastructure and social subsectors. Ports, power systems, roads, tourism and education account for a significant portion of these estimates, but debris removal and clean-up operations also represent a sizeable share of this appraisal.

Overall, the sector most affected by the hurricane was tourism. It is the driving force of the Anguillian economy; the central element of island activity and the main source of tax revenue.

The impact of Hurricane Irma on Anguilla's tourism sector will be severe. Damages are significant but even worse are the losses, which will extend several months beyond. Total damage is estimated at XCD \$275 million and is extensive, affecting buildings, equipment, furniture, and landscaping. The damages were caused mostly by intense wind, flying debris, and, in properties close to sea level, water surge. Most damage is concentrated in the large hotels and resorts (XCD \$203 million), which cater to high-end consumers. These facilities are especially costly and commonly have

Table 1. Effects of Hurricane Irma by sectors, XCD million.

Sectors	Damage	%	Losses	%	Additional costs	%	Total costs
<b>Infrastructure</b>	86.0	17.0%	41.3	12.5%	22.7	54.2%	150.1
<b>Productive</b>	277.7	54.8%	282.2	85.1%	7.7	18.4%	567.7
<b>Social</b>	143.2	28.2%	8.0	2.4%	11.5	27.4%	162.7
<b>Total</b>	507.0	100%	331.5	100%	41.9	100%	880.4

Source: Assessment Team, 2017

<sup>1</sup> This article is based on the report "Assessment of the Effects and Impacts Caused by Hurricane Irma" ECLAC, ECCB, Government of Anguilla.



additional equipment such as generators, water treatment plants, reverse-osmosis plants and even greenhouses. The estimated damage is XCD \$23.9 million in the Villas and XCD \$48.1 million in the medium size hotels and villas.

Losses—in accommodation, meals and drinks, shopping, and transportation—amount to XCD \$270.2 million, of which XCD \$101.2 million occurs in 2017, XCD \$168.1 million in 2018, and XCD \$898,000 in 2019. Reduced tourist arrivals will have spill over effects in the rest of the economy. The additional cost in the sector is XCD \$7.7 million.

Three sectors of infrastructure necessary for the optimal functioning of tourism such as power, telecommunications and roads, airports and ports suffered significant impacts. In the case of the power sector, wind damage to utility poles and overhead power lines was widespread and led to prolonged power outages on the island. Metal roofs failed atop power-generation and administrative buildings, causing damage to equipment inside. All photovoltaic panels on the company's 1.1-megawatt solar array were blown away or shattered by torsion and debris. A water tank used for fire suppression at the generation plant had structural damage from wind pressure.

The combined value of damage, losses and additional costs is an estimated XCD \$51.1 million. Physical damage to the power sector is estimated at about XCD \$24 million, of which about 56 per cent represents damage to transmission and distribution networks, 30 per cent is related to power generation, and 13 per cent is for buildings and equipment. Losses are estimated at XCD \$25.6 million, reflecting the value of power that was not sold because of damage to the transmission and distribution network and power that will not be sold due to reduced demand, as hotels remain closed through the high tourist season. Additional costs are estimated at XCD \$3.6 million. This figure mostly reflects

costs for crews and equipment brought in to support the recovery process.

Regarding telecommunications, Anguilla has more than 40 cellular towers, and Hurricane Irma knocked all but three offline. Many collapsed; others failed due to a loss of power, damage to equipment, or misalignment of antennas. The island's extensive overhead network of telecommunications wires, operated by FLOW and Digicel, also failed in many locations, particularly on the western portion of the island. This affected fixed-line telephone, broadband Internet, and cable television.

Damages to the telecommunications sector are estimated at XCD \$25.2 million. Digicel accounts for 57 per cent of the total damage, and FLOW, 41 per cent. The rest of the damage (2 per cent) is to the island's radio and television broadcasters. Losses are estimated at XCD 4.4 million; extended outages of broadband Internet, cable television, and landline services make up the bulk of that figure. Additional costs are estimated at XCD \$1.8 million.

The most affected social sector was housing. However, Anguilla's housing infrastructure was able to withstand Hurricane Irma better than most of the other islands in the Caribbean. Based on reports and field inspections, the assessment team determined that about 1,759 dwellings were affected. Of these, an estimated 3 per cent were destroyed, 5 per cent have significant structural damage, 13 per cent have minor damage, and 79 per cent have some damage. Most of the severely damaged houses were built with zinc roofs and tinder or plywood walls. This resulted in a total estimated damage of XCD \$83.7 million.

Losses refer to interruption of accommodation services due to severe damage or destruction of the housing stock, making it temporarily or permanently uninhabitable. The estimated losses for the 235 homes

deemed uninhabitable was XCD \$2.2 million. Additional costs are estimated at XCD \$7.9 million, including activities such as demolition of the most severely affected dwellings, debris cleaning, staff services, and equipment rental.

The overall impact on economic activity is projected to be significant in light of the crippling blow Hurricane Irma dealt to the local tourism sector. Its contraction will have a knock on effect in related subsectors such as wholesale and retail trade, transport and real estate business activities; however, this will be counteracted, to an extent, by an upsurge in construction activities as Anguilla's recovery progresses. It is still to be seen what would be the effect Irma on Anguilla's fiscal and debt sustainability, but its position will be considerably weakened. Given the sweeping effects of Hurricane Irma on the domestic economy, current revenues are projected to decline to XCD \$185.5 million compared with the pre-Irma target of XCD \$214.9 million. In light of the impacts previously discussed, an overall fiscal deficit of XCD \$45.4 million is projected compared with the pre-Irma deficit projection of XCD \$10 million.

ECLAC's disaster assessment team proffers sector-specific recommendations based on the analyses of several experts. These proposals are intended to inform a progressive national strategy that places resilience at its forefront. They form part of a comprehensive approach that aims to reduce the vulnerabilities that were identified during the DaLA mission, improve risk mitigation strategies, and promote multisectoral collaboration in the disaster risk management process. ■



## EFFECTS AND IMPACTS OF HURRICANE IRMA IN THE BAHAMAS<sup>2</sup>

Francisco Ibarra-Bravo

The three-year period of 2015-2017 has been particularly eventful in The Bahamas, with the country experiencing landfall of a Category 4 hurricane in each of those years. These were Hurricane Joaquin in 2015, Hurricane Matthew in 2016, and Hurricane Irma in 2017.

Hurricane Irma was the ninth named hurricane of the 2017 Atlantic Hurricane Season. Around 01:00 UTC-5 on Friday 8 September, the center of Hurricane Irma crossed the Bahamian island, Little Inagua, then passed south of Acklins Island. On the afternoon of that same day, the center of the hurricane passed about 15 miles to the south of Ragged Island. Later, the storm affected south Andros, Bimini and Grand Bahama.

**P**rior to Irma reaching The Bahamas, the Government executed an emergency evacuation plan for persons on the most threatened islands to be transferred to the capital, Nassau, in New Providence. This evacuation process included residents from Acklins, Crooked Island, Inagua, Long Cay, Mayaguana and Ragged Island. According to data provided by the Bahamian Ministry of Social Services, a total of 1,479 persons were evacuated. At the national level, 3,515 persons were housed in approximately 133 shelters activated during the disaster. The emergency evacuation was the largest in the history of The Bahamas, an important sign of its success being no deaths or injuries reported.

The effects of Hurricane Irma in The Bahamas were concentrated on five islands: Acklins, Bimini, Grand Bahamas, Inagua and Ragged Island. This group of islands has about 54,906 individuals, representing 16 per cent of the country's total population.

The total estimated damage of Irma was US \$32.3 million, the losses US \$86.9

million and additional cost of US \$11.4 million. The majority of the damage was concentrated in the social and infrastructural sectors, while the losses in the productive sector were mainly in tourism. Given that the economy was already facing a number of challenges before Hurricane Irma, the fiscal challenge remains a major concern in the Bahamas. Public debt has more than doubled since the global crisis, driven in part by a stimulus programme to boost economic activity after the crisis. Before Hurricane Irma, growth of 1.4 per cent was forecast for 2017. After the disaster, however, The Bahamas economy is now projected to experience a growth of 1.0 per cent. This lower economic activity would result in loss of earnings and wages and salaries of US \$25.4 million and US \$18.7 million. It is expected that the government will undertake additional borrowing, mainly from the domestic financial sector to finance its contribution to the recovery.

The overall impact was relatively small compared to previous hurricanes. Although the areas directly affected by Irma were low population density areas,

the impact was significant, particularly in Acklins and Ragged Island. According to the report of the housing sector, a total of 387 dwellings had some type of damage directly affecting 1,120 people. A total of 60 homes were also destroyed, resulting in the displacement of 171 persons. Damage to the Housing and Public Buildings sector was estimated to be US \$14.5 million, while losses were calculated at US \$0.4 million having regards to the 135 rental homes affected. Additional costs were assessed in respect of cleaning of debris, rental equipment, labour, staff services, damage to appliances, and furniture. These tasks accounted for another US \$2.2 million.

With respect to the impact on children's education, a total of 36 educational facilities and 5,788 students were affected. The damage to school property was estimated at US \$1.5 million and the value of instruction time lost was calculated at US \$1.5 million.

There was also significant damage to roads, airports, ports and other infrastructure. This damage was caused primarily by water surge rather than wind, except for the airport terminal building in Ragged Island that was destroyed by hurricane force winds. In this case, the estimated damage was US \$10.3 million, with losses of US \$2.2 million, and additional costs of US \$4.5 million. In the telecommunications sector, Hurricane Irma caused destruction to wires and utility poles, loss of commercial power to mobile installations and cable nodes, rain and salt water-

Table 2 - Effects of Hurricane Irma by sectors, US\$ million

Sectors	Damage	%	Losses	%	Additional costs	%	Total costs
Infrastructure	16.8	52.2%	2.4	2.8%	2.4	21.1%	21.7
Productive	13.8	42.6%	3.7	4.2%	9.0	77.8%	26.5
Social	1.7	5.2%	80.9	93.0%	0.1	1.2%	82.7
<b>Total</b>	<b>32.3</b>	<b>100%</b>	<b>86.9</b>	<b>100%</b>	<b>11.6</b>	<b>100%</b>	<b>130.8</b>

Source: Assessment Team, 2017

<sup>2</sup> This article is based on the report "Assessment of the Effects and Impacts Caused by Hurricane Irma" ECLAC, IDB, PAHO, Government of The Bahamas.

related damage to electrical equipment, breakage of undersea cables by drifting boats, and damage to buildings. Ragged Island suffered by far the most damage, followed by Andros, Bimini, Inagua and Grand Bahama. Damage was estimated at US \$2.1 million. At the same time, losses for telecommunications sales as a result of service outages were estimated at US \$0.1 million, plus additional costs at US \$0.5 million.

Damage in the power sector was primarily to transmission and distribution systems, and consisted of fallen power lines and utility poles, blown transformers, compromised insulators, and salt-spray accumulated on lines and equipment. The estimated damage was US \$0.8 million while losses, representing the amount of electricity that was not sold as a result of power outages, were estimated at US \$0.4 million. Additional costs, comprising of overtime for staff and transport for repair crews and equipment, were estimated at US \$0.7 million. With the exception of Bimini (the underwater line) and Ragged Island, there was no substantial damage to the Water and Sewerage Corporation (WSC) facilities on any of the other Family Islands. Water and Sanitation damage was approximately US \$0.5 million, due to the interruption of water distribution service to dwellings, and it was estimated that losses were approximately US \$0.9 million. Additional costs were estimated at US \$3.3 million.

Tourism is the main driver of the Bahamian economy. Unlike the previous storms, Irma did not directly affect the major tourism infrastructure of The Bahamas. Nevertheless, it was a major storm that received extensive news coverage for days before making landfall, thus causing significant disruption in the flow of tourists all over the Caribbean. The total damage in the tourism sector was US \$0.6 million, nearly all occurring in the Family Islands. The losses were much greater, escalating to US \$68 million, while additional costs were US \$0.1 million.

Another important economic activity

in The Bahamas is fishing. Although Irma did not cause significant damage in this sector, it affected the most important fishing area of the Bahamas, the Great Bahama Bank. It also affected communities whose main source of income is fishing. Hence the sector suffered US \$1 million in damage and US \$12.9 million in losses. The majority of the damages and losses were concentrated in New Providence and Spanish Wells, but in relative terms, the impact of Irma was stronger in small communities like Duncan Town and Saline Point.

Hurricane Irma demonstrated once more that natural hazards can damage infrastructure in a way that is felt across multiple sectors. In The Bahamas, most infrastructure assets – including roads, ports, and tourist facilities – are located close to the shoreline, exacerbating their vulnerability to hurricanes.

To reduce the risks in the infrastructure sector, the ECLAC Damage and Loss Assessment report recommended the development, reviewing and updating of the Sustainable Master Development Plan that considers the potential risks caused by disasters. The Plan should also focus on the integration of multiple sectors and their role in the improvement of human well-being. Bahamian authorities should also seek to update and deploy construction codes, standards and guidelines, and enforce their implementation.

In the tourism sector, it is crucial to ensure that repair and rebuilding efforts are done to the existing codes and standards. The water surge severely damaged properties close to the seashore, making it imperative that any new touristic development is done with the proper adjustments for shoreline impacts, and if required, complemented with the construction of stilts or seawalls. In agriculture, it is important that new greenhouses use materials that are more suitable for the weather conditions in The Bahamas. In addition, their design should be done in a more disaster resilient manner. This includes moving

away from square crystal greenhouses that are particularly vulnerable to wind damage.

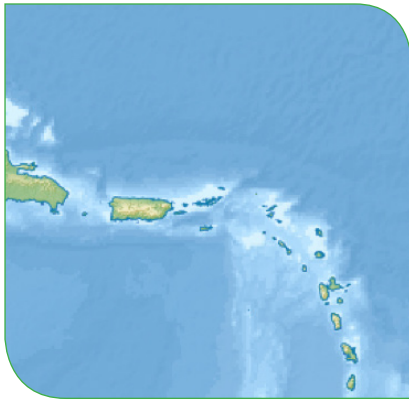
Regarding housing, enforcing the current building code is highly encouraged. To ensure such compliance, several steps could be taken. First, the creation of a popular builder's handbook is encouraged. The objective of this handbook will be to guide step by step the principles and technical methods required to comply with the building code. Secondly, the government should strengthen audit, inspection and supervision of buildings. Thirdly, the revision and update of the current building code should be undertaken. Similarly, for educational facilities, inspections of school premises should be mandatory and scheduled before the hurricane season every year.

In the telecommunications sector, the recent experiences of Hurricanes Joaquin and Matthew have already been a catalyst for the adoption of improved disaster risk management practices. For example, the Bahamas Telecommunications Company (BTC) has changed its approach to preparation prior to the hurricane season. BTC has also begun the process of retrofitting the antennas on its cellular communications towers with additional bracing. Their experience in Hurricane Irma has proven this to be an effective means of reducing the risk that antennas will be blown out of alignment by high winds.

The telecommunications company, Cable Bahamas, has made their network more resilient by adding “power to the node” systems. Loss of commercial power remains the greatest threat to the continuance of operational telecommunications services, particularly mobile services, during and after a disaster. Backup generators at cellular sites are a useful resolution.

Although Hurricane Irma represented a traumatic event for the people of The Bahamas, it should be seen as an opportunity to rebuild for resilience. ■





# EFFECTS AND IMPACTS OF HURRICANES IRMA AND MARIA IN BRITISH VIRGIN ISLANDS<sup>3</sup>

Omar Bello

The first gusts of Hurricane Irma began affecting the territory of the British Virgin Islands (BVI) in the early hours of 6 September 2017. Forecasters had predicted that the eye would pass just north of Anegada. However, the system shifted to the south and the eye passed directly over Tortola.

For six hours, Irma battered the territory resulting in four deaths and approximately 125 reported injuries. With telecommunications, VHF radio networks and the National Emergency Operations Centre (NEOC) headquarters destroyed, emergency transmissions were severely impaired. The Caribbean Disaster Emergency Management Agency (CDEMA) reported that the all-clear was expected to be given at 11:00 p.m. In view of the widespread devastation and deterioration of law and order, a state of emergency was declared on 7 September and a curfew implemented on 8 September.

The northern coast of Tortola was severely affected by storm surges, particularly the communities of Cane Garden Bay and Carrot Bay, where seaside cemeteries, schools and historic edifices were displaced. In the south, residents reported tornadic activity within the valleys surrounding Road Town with extensive damage in the Lower Estate area. The Balsam Ghut Prison Complex, Police Headquarters,

House of Assembly and main government building all suffered major damage. Nine out of 19 schools in the territory were left inoperative after the storm's passage. The island's infrastructure was also devastated as road networks, telecommunication systems, airport and seaport facilities were severely damaged.

Virgin Gorda sustained heavy damage, particularly in the North Sound region, with reports of 12 to 20 feet (3.7 to 6.1 m) of storm surge in some areas. Many tourist accommodations were also destroyed, while schools, emergency shelters and health facilities suffered significant water and roof damage. Jost Van Dyke's infrastructure was also crippled as the main water storage facility and most cellular towers were flattened. Several landslides were reported in the island's western region. Anegada suffered damage to some docking facilities and tourist accommodation; most regions experienced 2 to 5 feet (0.6 to 1.5 m) of storm surge. Similar reports of devastation were received from other Sister Islands.

Hurricane Maria approached BVI at 5 p.m. on Sunday 17 September, 2017. The National Hurricane Centre (NHC) in Miami, Florida, issued a Hurricane Watch for that country, advising of intense rainfall, flash floods, mudslides and possible danger from the debris left in Irma's wake. A continuous curfew was imposed the following day after consultations with the Governor and key government and private sector officials. The Category 5 system passed to the southeast of the island chain between 19 and 20 September, battering the territory with 155 mph (250 km/h) winds for over 12 hours. Though heavy rains continued, the hurricane warning was discontinued by 5 p.m. on Wednesday 20 September.

Most inhabitants were affected by the passage of Hurricanes Irma and Maria in one way or another. The assessment team estimated that approximately 17,985 persons were primarily affected as a result of some type of damage to their homes and other possessions. There were four deaths in the territory and about 125 related injuries after Hurricane Irma; no casualties were reported for Hurricane Maria. Approximately 351 registered persons occupied various shelters throughout Tortola. These included improvised informal shelters that housed more inhabitants. Although the inhabitants of the island of Anegada was advised to evacuate, only 106 persons did so, while 51 remained in a shelter.

Table 3 - Effects of Hurricane Irma by sectors, US\$ million

Sectors	Damage	%	Losses	%	Additional costs	%	Total costs
<b>Social</b>	664.2	40.3%	14.1	3.2%	66.7	33.7%	745.0
<b>Infrastructure</b>	291.1	17.6%	60.6	13.7%	103.3	52.1%	455.1
<b>Productive</b>	691.6	41.9%	365.3	82.3%	27.8	14.0%	1,084.8
<b>Environment</b>	2.7	0.2%	3.9	0.9%	0.4	0.2%	7.0
<b>Total</b>	1,649.7	100%	443.9	100%	198.2	100%	2,291.8

Source: Assessment Team, 2017

<sup>3</sup> This article is based on the report "Assessment of the Effects and Impacts Caused by Hurricanes Irma and Maria" ECLAC and The Government of British Virgin Island.



that the total cost of Hurricane Irma in the British Virgin Islands is US \$2.3 billion. This cost consists of three elements: damage, revenue and other income losses, and additional costs—such as debris removal.

Of this total, damages are estimated at US \$1.6 billion. The productive sectors suffered 41.9 per cent (US \$691.6 million) of the total damage, followed by social sectors, 40.2 per cent, and infrastructure, 17.6 per cent.

Losses are estimated at US \$444 million, of which 82.2 per cent is in the productive sectors, 13.7 per cent infrastructure sectors, and 3.2 per cent social sectors. Additional costs are estimated at US \$198.2 million, of which 52.1 per cent is in the infrastructure sectors, 33.7 per cent social sectors and 14.0 per cent productive sectors.

Public sector assets account for 14.5 per cent of the total damage, 9.5 per cent of the total losses, and 43.9 per cent of the additional costs. The public sector will be required to spend US \$243.3 million to replace damaged assets. In a reconstruction process it is expected that this expense will be greater than damage estimates due to improvements not only in quality but also in efforts at disaster risk reduction.

Overall, the sector most affected by the hurricane is tourism, sustaining 46.6 per cent of total costs, 41.3 per cent of damage and 81.5 per cent of total losses.

The economy of the British Virgin Islands relies heavily on the tourism sector as a main source of employment for the people of the territory. Additionally, since the nature of tourism in the territory makes water proximity a highly valued amenity, many tourist facilities are very close to the seashore, which adds an extra risk due to water surge. The total cost of Hurricanes Irma and Maria in the tourism sector is US \$1.06 billion.

The total damage estimated for the tourism sector is US \$682 million, mainly in the land-based infrastructure, which accounts for damages of US \$482 million. The total damage in the sea-based tourism is US \$177 million, of which US \$166 million is related to damages in the vessels. A total of 205 chartered vessels were damaged, including a good number of wrecked vessels on the shore, either capsized or extensively damaged by debris. Losses are estimated at US \$362 million, and land and sea based accommodations account for about US \$264 million of that total. Additional costs include US \$17 million for preparations to safeguard property both on land and sea, as well as costs for removal of debris, general cleaning and operating costs for electrical generators.

Hotel infrastructure is severely damaged and many will not be fully operational until 2019. Tourism losses amount to US \$361.8 million, of which US \$121.5 million occurred in 2017, US \$217.3 million in 2018, and US \$22.0 million in 2019.

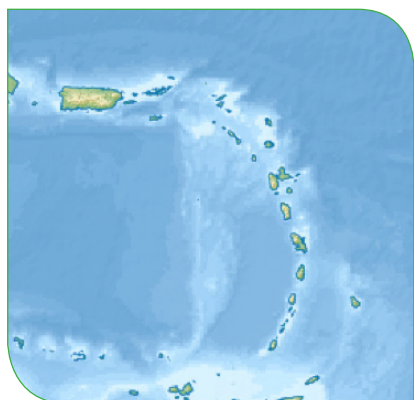
The most affected social sector was housing and public buildings. The overall cost to the sector is estimated at US \$680.2 million. Housing was one of the sectors most severely affected by Hurricanes Irma and Maria, with a total of 6,944 residential buildings affected. A significant number of public buildings such as schools, health establishments, post offices, and fire and police departments also sustained severe damages and losses. The main damages were wind damage to roofs and walls, water damage as a result of rain intrusion, and impacts caused by flying debris. Of the residential buildings affected throughout the four main islands, 14 per cent have major damages and cannot be repaired, 16 per cent have major damage but can be repaired, 22 per cent have some damages but can still be safely occupied and 47 per cent have minimal damage and can be easily repaired.

The losses are calculated at US \$12.3 million as a result of the interruption of accommodation services due to severe damage or destruction of the housing stock, making it temporarily or permanently uninhabitable. Additional costs are estimated at US \$65.9 million, which includes costs for demolition of the most affected dwellings, the clearing of debris and use of diesel or gas generators. Electricity is not yet fully restored throughout the territory. The most affected infrastructure sector was roads, airports and ports. The effects of the wind force and sea surge, as well as the occurrence of isolated tornados associated with the storm, created devastating levels of damage to the transportation infrastructure of Anegada, Jost Van Dyke, Virgin Gorda and Tortola.

The estimated damage to this subsector is US \$205.8 million for roads, bridges, sea wall, ports, marines, docks, airports, and transportation equipment (public and private vehicles and boats). Additional costs related to debris removal, fencing and other related tasks are estimated at US \$28.2 million. Losses are estimated at US \$17.9 million.

The environment sector of the BVI was also impacted by these events, estimated at US \$2.7 million. This includes damages to ecosystems (i.e. corals, mangroves, beaches and seagrass beds) and other environment-related infrastructure assets.

Losses are estimated at US \$3.9 million due to substantial impacts on ecosystem services. Additional costs account for US \$370,000, reflecting expenditures of environmental organisations, such as Jost Van Dyke Preservation Society and the Association of Reef Keepers, to normalise their operations. ■



## EFFECTS AND IMPACTS OF HURRICANE IRMA IN SINT MAARTEN<sup>4</sup>

Robert Williams

Irma was the most powerful hurricane to have struck Sint Maarten in recent decades. The Category Five hurricane passed directly across the country on the morning of Wednesday 6 September, 2017. The situation was exacerbated by Hurricane Maria, which passed south of the country on 20 September, bringing two to five inches of rainfall and tropical storm-force winds to an already battered territory.

All residents of Sint Maarten were affected in some way by Hurricane Irma. The disaster assessment team estimated 34,000 persons sustained damage to their homes of varying degrees. After the passage of Irma, approximately 250 – 300 patients sought medical attention within 24 hours. These patients were primarily treated for physical trauma and wounds caused by flying debris and falling objects. There were two hurricane-related deaths reported.

Although there were designated shelters throughout the country, these were not constructed to withstand a Category 5 hurricane. Usage was recommended only as a last resort; the government instead advised citizens to remain in their homes, and many found shelter with neighbours or relatives. In the aftermath, approximately 400 people utilized the shelters. In addition, thousands of tourists, students, patients and residents evacuated Sint Maarten before and immediately after the passage of Irma.

These storms were a major economic setback for Sint Maarten, causing

extensive damage not only to housing and infrastructure, but also to the commerce and tourism sectors, which are the country's dominant sources of revenue and employment.

The assessment team estimated that the total cost of Hurricane Irma in Sint Maarten is US \$2.1 billion. This cost consists of three elements: damage, revenue and other income losses, and additional costs — such as debris removal.

Of this total, damages are estimated at US \$1.1 billion. Social sectors suffered 47.9 per cent (US \$502.1 million) of the total damage, followed by productive sectors, 28.2 per cent, and infrastructure, 19.3 per cent.

Losses of revenue and other income were estimated at US \$987 million. In terms of losses, the productive sector was the worst affected, accounting for 87.7 per cent of losses. The infrastructure sector bore 8 per cent while the social sector assumed 3.7 per cent of losses. 91 per cent of losses were assumed by the private sector.

Additional costs were estimated at US \$52.9 million, of which 61.4 per cent were in the infrastructure sectors, 21.1 per cent social sectors and 17.2 per cent productive sectors.

Overall, the sector most affected by the hurricane was tourism, which sustained 52.1 per cent of total costs, 21.3 per cent of damage and 86.6 per cent of total losses. Hotel infrastructure was severely damaged and many facilities will not fully recover their operations until 2019, if at all. Tourism losses amount to US \$855.5 million.

The social sector with the most severe cost was the housing sector. There was damage to 90 per cent of buildings, mostly due to the loss of roof covering and damage to windows and doors. There was wind and water damage to the interior of the buildings, including electrical and mechanical equipment, creating a significant amount of losses. It was estimated that there are about 12,713 dwellings affected, including 2,044 severely damaged and destroyed. Most of the severely damaged were built of zinc roofs with tinder or plywood walls.

In the aftermath of Hurricane Irma, the total cost for the education sector in Sint Maarten was estimated at US \$21.7 million. Many of the damages were directly related to poorly maintained buildings and substandard construction workmanship. The losses were confined primarily to loss in teaching time as many of the schools were closed. The closure period averaged from four to six weeks among the public schools and two weeks for private schools.

Table 4 - Effects of Hurricane Irma by sectors, US\$ million

Sectors	Damage	%	Losses	%	Additional costs	%	Total costs
Infrastructure	202.1	19.3%	79.3	8.0%	11.2	21.1%	292.6
Productive	343.4	32.7%	866.3	87.7%	9.1	17.2%	1,218.8
Social	502.1	47.9%	36.6	3.7%	32.5	61.4%	571.1
Environment	1.0	0.1%	5.3	0.5%	0.1	0.2%	6.4
<b>Total</b>	<b>1,048.6</b>	<b>100%</b>	<b>987.5</b>	<b>100%</b>	<b>52.9</b>	<b>100%</b>	<b>2,089.0</b>

Source: Assessment Team, 2017

<sup>4</sup> This article is based on the report "Assessment of the Effects and Impacts Caused by Hurricane Irma" ECLAC, ECCB, Government of Sint Maarten.



The total estimated cost for the health sector was US \$6.9 million. Many of the medical facilities sustained damages, mainly roof damage which, once compromised, then resulted in damage to equipment, furniture and supplies. However, there was little physical damage to the operating room facilities.

The infrastructure sector with the most severe cost was the transportation sector – including roads, ports and airports. Damages were mainly as a result of winds exceeding 190mph (305 km/h) as well as storm surge in the vicinity of the Princess Juliana International Airport (PJIA). The damages to sea ports were recorded as major. These included one of the piers at Phillipsburg Harbour, buildings which mainly sustained roof damage, and damage to 1.2 miles (2 km) of perimeter fencing. The estimation of damages in this sector was US \$76.3 million, while losses were US \$33 million.

Telecommunications infrastructure also sustained severe damage during Hurricane Irma. TelEm, the government-owned telecommunications operator, did manage to maintain wireless services through 11 of 31 cellular towers during the storm, but was challenged to keep these systems running in the absence of commercial power, as backup batteries ran out and diesel generators had to be refuelled. UTS, TelEm's main competitor in the wireless space, had its entire network go off-air because a collapsed tower on the roof of its building caused damage to its core equipment room, causing an emergency shutdown. Exposed elements of fixed telephone, cable television, and broadband internet systems also experienced widespread damage, though much of the core infrastructure for these systems was buried underground, and thus protected from the effects of wind. Damages to telecommunications infrastructure was estimated at US \$50.6 million, and losses in the sector were US \$11.8 million.

Damage to infrastructure in the power sector was estimated at US \$5.9 million, of which US \$150,000

was related to damage to generation buildings and equipment, US \$2.2 million was damage to the transmission and distribution network, and US \$3.6 was to administrative buildings and equipment. Sint Maarten's investment in burial of power lines helped to limit damage in the power sector, and also enabled the country's power grid to be mostly restored within a span of about six weeks, as compared to six months for some other territories affected by the recent hurricanes.

Sint Maarten's water infrastructure was severely damaged, causing great losses and challenges to restore water service. Right after Hurricane Irma, the interruption of power, along with damages to storage and distribution infrastructure prevented production of water. More than half of the water storage capacity of the island presented damages, leaks in several distribution lines and residential connections. Damages to the waste water treatment plant were in the power and control connections. The solid waste service was affected with the debris and the loss of three garbage trucks.

The economy of Sint Maarten relies heavily on the tourism sector. Phillipsburg is the second most visited port in the Caribbean and the country receives around 1.7 million cruise visitors every year. It also receives close to 530,000 stopover visitors a year. Together, these visitors spend about US \$820 million a year.

The impact of Hurricane Irma on Sint Maarten's tourism sector will be severe and long-lasting. The damages are significant but even more relevant are the projected losses, which will have knock-on effects throughout the economy. Total damage is estimated at US \$223 million, with extensive impacts to buildings, equipment, furniture, and landscape. The losses amount to US \$856 million, of which US \$244 million are estimated for 2017, and US \$486 million and US \$126 million projected for 2018 and 2019 respectively.

The commerce sector is a major employer in the country; close to 30

per cent of those with a job work in this sector. The impact of Hurricane Irma on Sint Maarten's commercial sector was considerable, and in the aftermath of the storm, there were lootings and violence that aggravated the damages and losses. Total damage in the commercial sector is estimated at US \$120 million. The losses in this sector were relatively small (US \$11 million), and were concentrated in the three months after the storm. After the initial losses, the sector benefitted from increased activity associated with the recovery effort.

Ecosystems suffered greatly from the impact of Hurricane Irma. The storm surge and wave action swept the natural assets of the island. Corals and mangroves were destroyed, beaches washed away and forests cleared of their foliage represented just some of examples of the impacts of Irma to nature in Sint Maarten. As a result, ecosystems were left in a critical state and pre-existent vulnerabilities were exacerbated.

These ecosystems are home to a wide variety of species of flora and fauna and provide services that are essential to the development of the island. For example, the tourism sector relies upon the scenic beauty of the ecosystems, and their associated flora and fauna, to attract visitors. In addition, the fisheries sector depends on the good health of underwater vegetation in order to assure that fish species can reproduce and find habitat near the island.

Damage to ecosystems account for around US \$1 million. Due to the inherent difficulty of assigning a price tag to a coral reef, a seagrass bed, or a sea turtle, the value reflected in this damage estimation only reflects calculations based on the cost of restoration projects. Since ecosystems are crucial to the economy and society of the island, it is expected that the impacts of the hurricane on their ecosystem services are substantial. Hence, losses to the environment sector were estimated at US \$5.3 million. ■



## EFFECTS AND IMPACTS OF HURRICANES IRMA AND MARIA IN TURKS AND CAICOS ISLANDS<sup>5</sup>

Leda Peralta

The Turks and Caicos Islands were affected by Hurricanes Irma and Maria over the span of two weeks. Hurricane Irma made landfall on the night of 7 September 2017 with wind speeds of more than 175 miles per hour (282 km/h); and on 23 September, Hurricane Maria made landfall with 125 mph (201 km/h) winds and storm surges of up to 12 feet (3.7 m).

**T**he approach of Hurricane Irma was tracked and anticipated for days, leaving ample time for preparations to be made. Warning systems were activated in a timely manner which allowed people to evacuate or seek shelter in advance. Registries indicate that 985 persons were evacuated to 14 registered shelters as a consequence of Hurricane Irma, while 442 were sheltered in nine facilities due to Hurricane Maria. In addition, several unregistered shelters were operational, and many individuals sought shelter with family members or friends.

The hurricanes caused moderate damage throughout the country due to excess rainfall, strong winds and storm surge. The assessment of the housing subsector indicated that 17,220 persons (55 per cent of the total population) were affected by the hurricanes, as a result of damage to 5,740 homes. In the public education sector, 3,977 students and 305 teachers were affected due to school interruptions caused by damaged

facilities or lack of access to schools which were used as shelters. The health sector suffered minor damage, which allowed it to remain operational within two to four days. Emergency services operated normally, and preventative measures were deployed to support patients with special needs or chronic illnesses.

Regarding infrastructure, the power system was severely damaged, with islands such as Grand Turk sustaining infrastructural damage in as much as 90 per cent. Although power generation was not affected, damage to 1,485 poles and 500 transformers caused nationwide outages that lasted for over than six weeks. Reduced electricity supply affected health facilities, access to water, telecommunications services, and recovery efforts. All islands lost telecommunications on the night of Hurricane Irma and remained offline for approximately one week. Of the productive sectors, tourism, was severely affected, accounting for most

of the damages and losses sustained by the country.

Total damage was estimated at US \$289.6 million (17 per cent public to the public sector and 83 per cent in the private sector), mainly due to damage in the tourism and housing sectors. The social and the productive sectors accounted for 44.1 per cent, followed by infrastructure with 11 per cent and environment with 0.5 per cent of total damage. Damage to hotels and tour operations accounted for the majority of damage in the productive sector, and housing in the social sector.

Regarding the housing sector, residential settlements along or near coastlines suffered heavy damage as a result of the intense force of winds. Houses throughout the islands suffered significant structural damage including damage to roofs, water damage as a result of rain intrusion, or were impacted by the effects of falling trees and flying debris and storm surge.

Table 5 - Effects of Hurricane Irma by sectors, US\$

Sectors	Damage	%	Losses	%	Additional costs	%	Total costs
<b>Social</b>	126.6	43.7%	7.9	3.4%	12.7	32.6%	147.2
<b>Infrastructure</b>	33.7	11.6%	26.8	11.6%	19.4	49.8%	79.9
<b>Productive</b>	127.8	44.1%	195.7	84.9%	6.5	16.8%	330.1
<b>Environment</b>	1.5	0.5%	0.0	0.0%	0.2	0.5%	1.7
<b>Total</b>	289.6	100%	230.4	100%	38.9	100%	559.0

Source: Assessment Team, 2017

According to official data provided by the authorities and based on field inspections, 5,740 homes sustained damage due to the effects of Hurricane Irma. In the affected islands, about 54 per cent of the dwellings were affected; approximately 12 per cent of the houses were severely damaged. Grand Turk and North Caicos were the territories that sustained most damage to properties. At the same time, this event impacted more than 200 public buildings,

<sup>5</sup> This article is based on the report "Assessment of the Effects and Impacts Caused by Hurricanes Irma and Maria" ECLAC and the Government of Turks and Caicos.



including government offices, churches and shelters, among others. Damage to the housing and public building sector is estimated at US \$119.5 million.

The majority of tourist facilities in Turks and Caicos are located near the shoreline, making them vulnerable to storm surges and other damage. As a result, Hurricane Irma caused severe damage to the tourism sector throughout the country.

Unlike the experience elsewhere in the Caribbean, damage to the buildings was relatively limited. The concrete structures through the country resisted hurricane winds of considerable magnitude. However, there was extensive damage to roofs, windows, sliding doors, guardrails, pools, seashores, and grounds. There was no structural damage in any of the buildings visited, and all the managers and business owners stated that they were planning to reconstruct and restart operations. Regarding insurance, most of the properties are insured. Some even had loss of business insurance. There seemed to be no under insurance in the major and medium business sector, but, as is the case in other countries, insurance coverage was inadequate among smaller businesses.

The total estimated damage in the tourism sector amounted to US

\$126.6 million. All-inclusive resorts, just five properties, accounted for US \$50.4 million. Damages for hotels was estimated at US \$66.2 million, while the estimated damages to villas was US \$10.1 million.

Losses, are estimated to be US \$230.4 million (5 per cent public sector and 95 per cent private sector). Losses in the productive sector were estimated at US \$195.7 million, accounting for 85 per cent of the total estimated losses. This was followed by the infrastructure sector, with 11.6 per cent of the losses, mainly due to airport and port closures, and forgone income in the power and telecommunications subsectors.

The total estimated losses for the tourism sector were US \$195.4 million. Seventy-five per cent of the losses, US \$147.5 million, occurred in 2017. For the first quarter of 2018, the forecasted forgone income is US \$47.9 million.

The losses in the tourism sector were due to moderate damage to hotels and villas, but it is expected that the stock of rooms would be fully functional by the end of March 2018. The airports and ports were also affected, limiting the flow of visitors. The interruption of public services implied that a number of accommodations could not be operational. Power was restored five weeks after the event, and

broadband internet had not been fully restored at the beginning of November 2017. Finally, the news coverage and disruption in the main airports of the USA caused booking cancellations and limited the number of tourists visiting the islands.

Additional costs were estimated at US \$38.9 million. Although the public sector accounted for most additional costs in the social sectors, the private sector, especially power and tourism, accounted for most of the incurred costs given the need to restore services as soon as possible. The power sector accounted for 42 per cent of the additional costs given the extent of the damage suffered by its infrastructure and the urgent need to restore the service. Therefore, additional costs in the infrastructure sector were 49.7 per cent of the total, followed by the social sector with 32.5 per cent as a result of providing temporary housing to the affected families.

The report of the effects of Hurricanes Irma and Maria is expected to be a valuable input in the design of the recovery plan for Turks and Caicos. ■

### JANUARY

**22 - 24 January 2018**

Promoting Carbon Markets in Latin America and the Caribbean, High Level Regional Dialogue on Carbon Pricing and MRV in the Americas - Santiago, Chile

### FEBRUARY

**23 February 2018**

Second meeting of the task force for advancing the ECLAC debt for climate adaptation swap initiative - Port of Spain, Trinidad and Tobago

### MARCH

**23 March 2018**

Meeting of the Technical Advisory Committee of the Regional Coordinating Mechanism (TAC/RCM) - Port of Spain, Trinidad and Tobago

## List of Recent ECLAC Documents and Publications

Listed by Symbol Number, Date and Title

### **LC/CAR/2017/21**

**December 2017**

Evaluation report of the workshop on TradeCAN, MAGIC PLUS and WITS

### **LC/CAR/TS.2017/12**

**January 2018**

Disability, human rights and public policy in the Caribbean: A situation analysis

### **LC/CAR/TS.2017/13**

Monitoring trade agreements: improving export performance and promoting industrialization in the goods-producing economies of the Caribbean

### **LC/CAR/TS.2017/15**

Economic impact of de-risking on the Caribbean: Case studies of Antigua and Barbuda, Belize and Saint Kitts and Nevis







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