CARIBBEAN PERSPECTIVES OF THE IMPACT OF CLIMATE CHANGE ON ENVIRONMENTAL DETERMINANTS OF HEALTH

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CLIMATE CHANGE – KEY FACTS AND FIGURES FOR THE CARIBBEAN

- Mean surface temperatures in the Caribbean have increased by ~ 1.0 degree Celsius over pre-industrial times. Warming is occurring at ~ 0.2 degrees Celsius per decade. 1.5°C of warming may occur by 2030. (IPCC, 2018)
- Sea levels are rising at ~ 3 mm/year and the rate of sea level rise is increasing. (IPCC, 2013)
- Global mean sea level rise suggest an indicative range of 0.26 to 0.77 m by 2100 for 1.5°C global warming. (IPCC, 2018)
- SLR at the equator will be higher than the global mean. (IPCC, 2013)
- The Caribbean Sea and the Atlantic Ocean are becoming more acidic. (SCOR, 2009).
- 70 - 90% of coral reefs will die at 1.5°C of warming. 99% of coral reefs will die at 2.0°C of warming. (IPCC, 2018)

3 CLIMATE CHANGE – KEY FACTS AND FIGURES FOR THE CARIBBEAN CONT.

- Rainfall patterns are changing – Climate Studies Group UWI Mona
- *"The prevailing pattern is a tendency towards more intense rainfall events over zones 1 to 4, with less consensus changes in the dry and wet spell lengths. The suggestion for zone 5 is that drier conditions will prevail."* (McClean et. al. 2015).
- Translation: more storms in the

northern Caribbean and more droughts

in the southern Caribbean

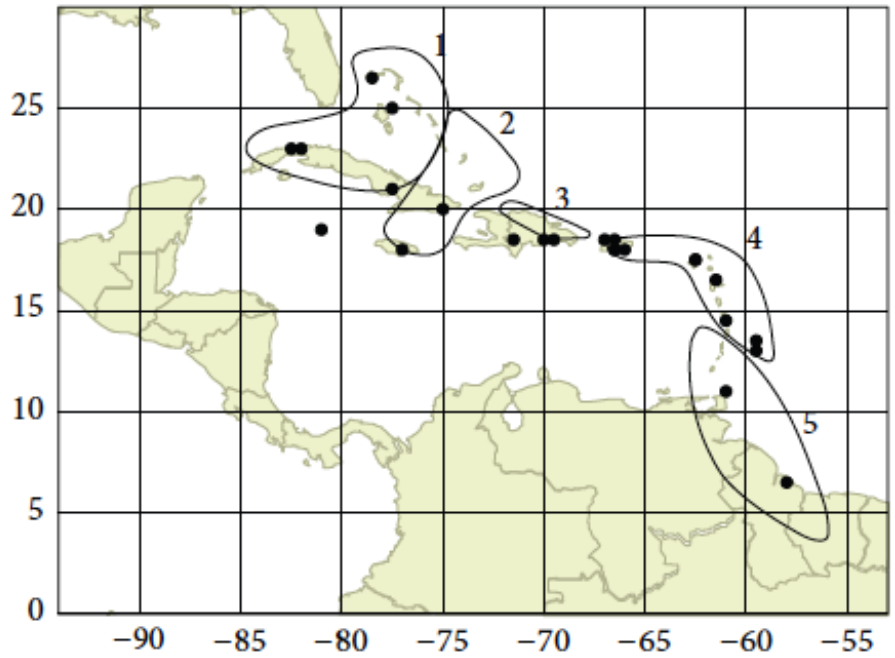
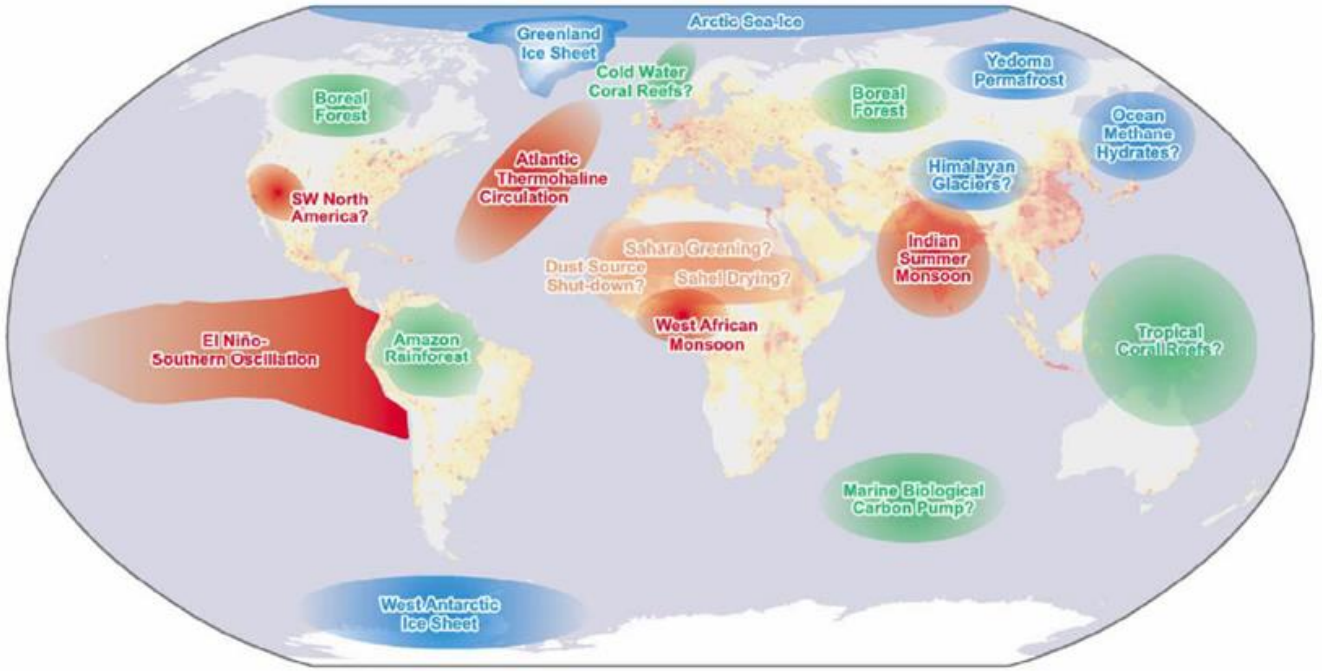


FIGURE 1: Five rainfall zones over the Caribbean and neighbouring regions. Observational weather stations used in this study are also shown.

CLIMATE CHANGE – KEY FACTS AND FIGURES FOR THE CARIBBEAN CONT.

- Migration and breeding habits of vectors (e.g. Aedes aegypti) are changing. (Chadee, D. & Martinez. R., 2016)
- According to the CCCCC (http://www.caribbeanclimate.bz/) A 1°C increase in sea surface temperatures will cause a 1- 8% increase in hurricane wind speeds and a 6-18% increase in core rainfall from hurricanes.
- Two Category 5 hurricanes hit the Caribbean in 2017 (unprecedented).
- Dominica's total damages and losses from hurricane Maria in 2017 have been estimated at $1.3 billion – about 226% of the country's GDP. And losses for Anguilla, Bahamas, BVI, St Maarten, Turks & Caicos following hurricanes Irma and Maria have been estimated at US$ 5.4 billion. (UNCTAD, 2018)

Updated Map of Tipping Elements in the Earth System



- Melting
- Circulation Change
- Biome Loss

Population Density [persons per km²]

no data | 0 | 5 | 10 | 20 | 100 | 200 | 300 | 400 | 1000

Hans Schellnhuber after T. Lenton

ENVIRONMENTAL DETERMINANTS OF HEALTH

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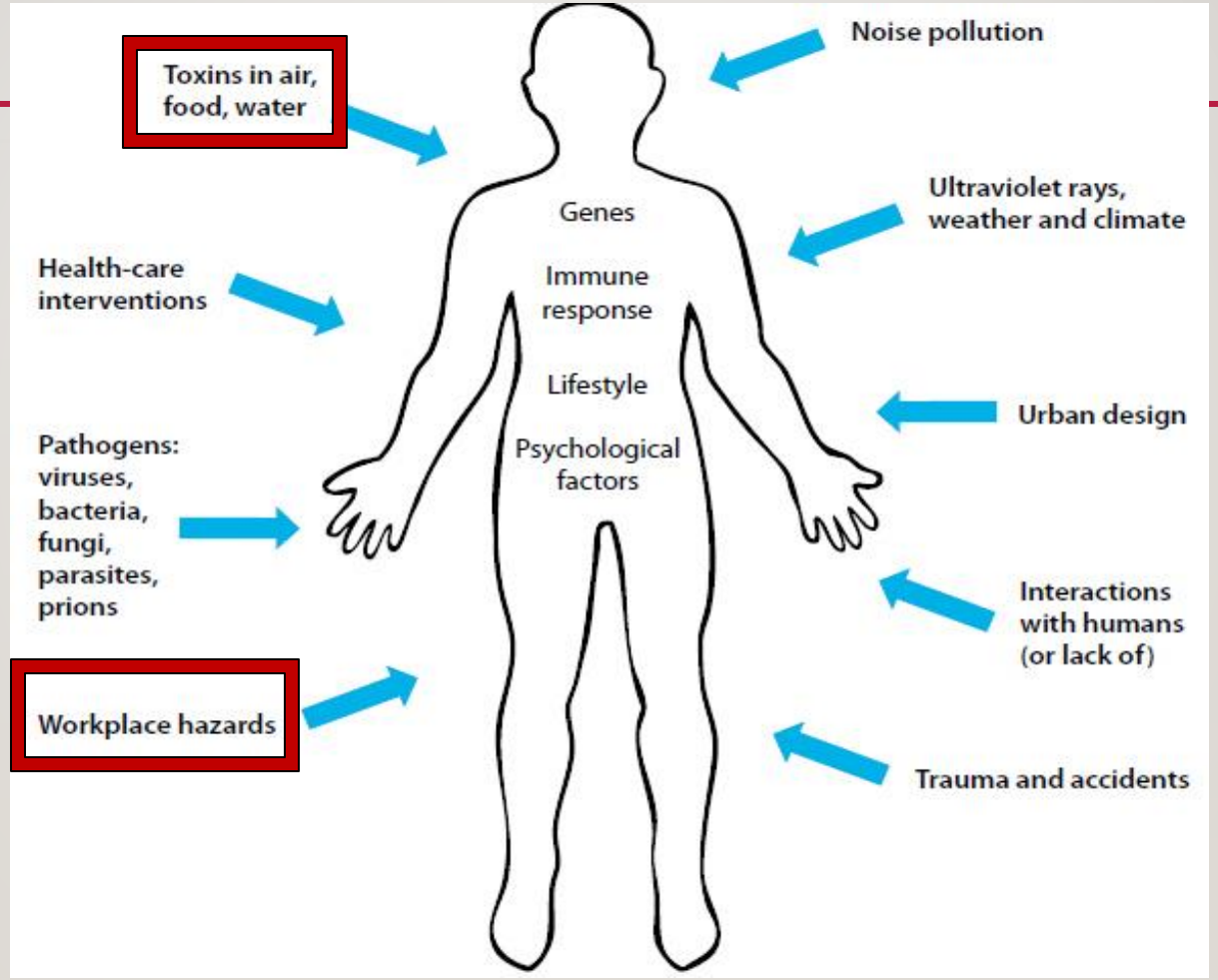

EFFECTS OF CC ON HEALTH

Weather Related Morbidity and Mortality **(increase)**

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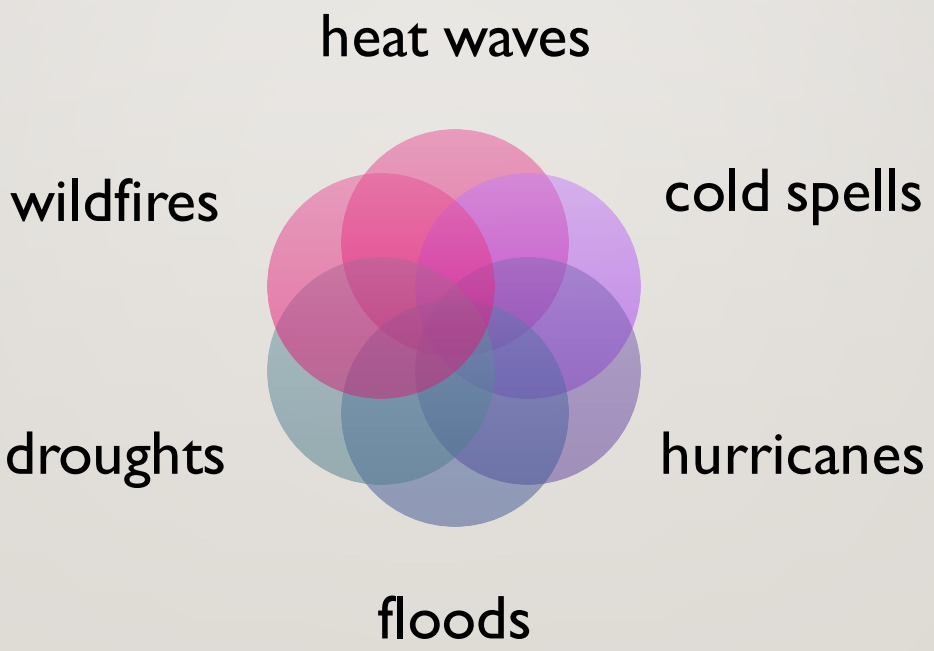
- Increases in the incidence and intensity of extreme weather events with **direct negative impacts on human health**



8 INDIRECT EFFECTS OF CC ON HEALTH

Respiratory Diseases **(increased prevalence)**

- Due to exposure to
  - **pollen** (due to altered growing seasons)
  - **molds** (from extreme or more frequent precipitation)
  - **air pollutants** and **aerosolized marine toxins** (due to increased temperature, coastal runoff, and humidity)
  - **dust** (from droughts)

9 INDIRECT EFFECTS OF CC ON HEALTH CONT.

Cancer **(increased prevalence)**

- Due to
  - increased duration and intensity of **ultraviolet (UV) radiation**
  - changes in **exposure pathways** for chemicals and toxins

10 INDIRECT EFFECTS OF CC ON HEALTH CONT.

Food and Water Insecurity **(increased prevalence)**

- Resulting in
  - **food and water borne illnesses**
    - increased agrochemical use for food production
    - proliferation of disease-causing biological agents
  - **malnutrition**
    - particularly during the prenatal period and early childhood as a result of staple food shortages and food contamination

11 INDIRECT EFFECTS OF CC ON HEALTH CONT.

Vector borne and Zoonotic Diseases

(increased prevalence)

- Due to
  - expansions in vector ranges
  - shortening of pathogen incubation periods
  - Increased feeding rates
  - disruption and relocation of large human populations

INDIRECT EFFECTS OF CC ON HEALTH CONT.

Mental Health **(negatively affected)**

Geographic displacement of populations, damage to property, loss of loved ones, and chronic stress *results in…*

…increased drug and alcohol abuse, domestic violence, depression, anxiety, PTSD, suicide

FAST **FACTS**

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- Up to 54% of adults and 45% of children suffer **depression after a natural disaster**

- 49% of Hurricane Katrina survivors developed **mental disorders**
- Due to changing climatic conditions in countries where dengue is endemic, the capacity for one of the main mosquitoes (*Aedes aegpyti*) to transmit **dengue fever** has **increased** globally since 1950 by 9.5%.
- Between 2030 and 2050, climate change is expected to cause approximately 250 000 additional deaths per year, from **malnutrition**, **malaria**, **diarrhea** and **heat stress**
- The incidence of **melanoma** increased by 60% between 1982 and 2010 in Australia

14 PROJECTED ECONOMIC IMPACTS OF CLIMATE CHANGE ON THE CARIBBEAN

- Limited data appear to exist on existing or predicted economic impacts of CC in the Caribbean.
- Simpson et. al., 2010 in a UNDP study focused on the impacts of SLR and concluded the following:
  - Some impacts are now inevitable. E.g. SLR of **> 1 metre by 2100** in the Caribbean cannot now be stopped.
  - Major coastal defence projects will be required to protect hundreds of kilometres of vulnerable coastlines **by 2050**.
  - Significant relocation of people and existing coastal infrastructure will be necessary **by 2050**.
  - All Caribbean countries will be impacted. The smaller islands will suffer the worst proportionately.

IMPACTS FROM A 2M SLR IN THE CARICOM NATIONS INCLUDE (SIMPSON ET. AL, 2010):

- Over 3,000 km^2 of land area lost (e.g., 10% of The Bahamas, 5% of Antigua and Barbuda).
- Over 260,000 people displaced (e.g., 10% of population of The Bahamas, 6% of Antigua and Barbuda).
- At least 233 multi-million dollar tourism resorts lost, with beach assets lost or greatly degraded at the majority of tourism resorts.
- Damage or loss of 9 power plants.
- Over 3% of agricultural land lost, (12% in The Bahamas, 8% in St. Kitts and Nevis, 5% in Haiti).
- Loss of 31 (42%) of CARICOM airports.
- Land surrounding 35 sea ports inundated (out of 44).
- Loss of 710 km of roads (e.g., 19% of road network in The Bahamas).

AREA OF GRENADA PROJECTED TO BE LOST WITH A 2M SLR

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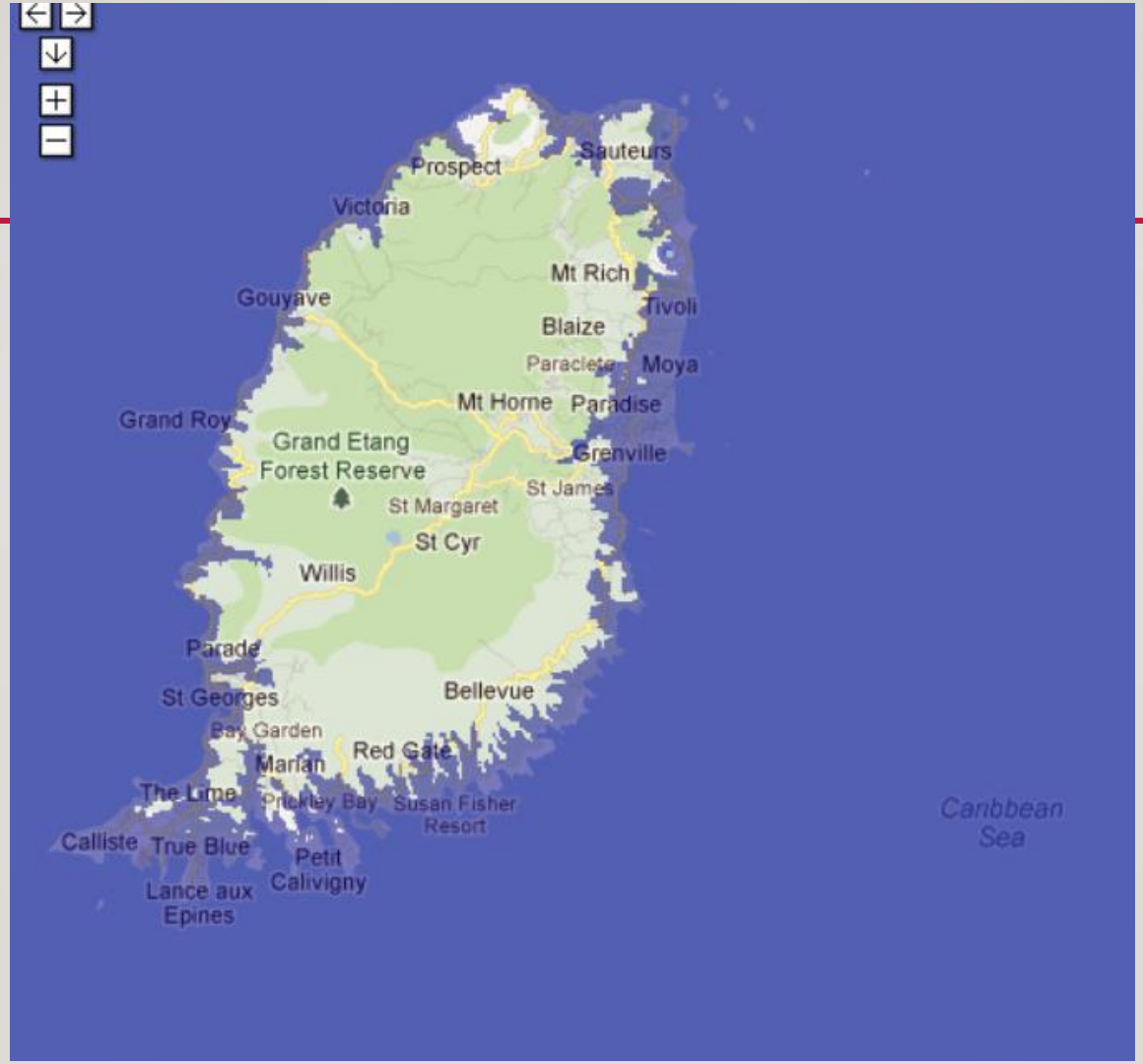

Source: Ministry of Environment, Govt. of Grenada

SUMMARY OF PREDICTED REBUILD COSTS OF TOURISM RESORTS FOR SELECTED ISLANDS (SIMPSON ET. AL. 2010)

Country	Tourism Resort Rebuild Costs by 2050 (US 2010$ M)	Tourism Resort Rebuild Costs by 2080 (US 2010$M)	Costs as % of GDP in 2050
Antigua & Barbuda			36
The Bahamas (annually)	869 - 946	2200 - 2600	
Barbados (annually)	283 - 368	850 - 860	4.8 – 18.7
Grenada (cumulative)	490 – 1,100	1300 – 3700	12.4 – 21.5
St. Kitts & Nevis			60 - 89

ECLAC STUDY (2011)

- The Economic Commission for Latin America and the Caribbean (ECLAC) produced the most comprehensive study to date of the projected economic impacts of CC in the Caribbean (ECLAC, 2011).
- The study looked at impacts on the following sectors:
  - Agriculture
  - Coastal and Marine Environment
  - Tourism
  - Transportation, and
  - Human Health

ECLAC'S CONCLUSIONS ON CC AND HUMAN HEALTH

- Caribbean countries are potentially particularly vulnerable because they tend to have a dual disease burden:
  - many endemic and environmentally-sensitive disease vectors
  - Human populations with high rates of cardio-respiratory diseases.
- ECLAC also notes that public health systems *"are generally underfunded"*.

ECLAC'S CONCLUSIONS ON CC AND HUMAN HEALTH CONT.VECTOR-BORNE DISEASES

- Malaria and Dengue are identified as the the two most important vector-borne diseases in the region.
- Between 2001 and 2009, there were 211,937 registered cases of dengue fever in the Caribbean.
- Climate Change is expected to increase dengue fever transmission by 300% (increased temperature reduces incubation time of the parasite)
- Wet season is the time of greatest risk of transmission.

ECLAC- WATERBORNE AND FOOD-BORNE DISEASES

- CC can cause possibly higher levels of pathogens in local water resources (fresh and marine).
- Waterborne diseases of most relevance in the region:
  - Gastroenteritus
  - Leptospirosis
- In Trinidad and Tobago, the number of new leptospirosis cases had increased significantly over the period 1981 to 2007, with more than 2,500 cases reported during this period.
- A study in 2008 showed a clear association between changes in precipitation and reported leptospirosis incidence in Guadeloupe.

ECLAC- OTHER POTENTIAL HEALTH IMPACTS

- Heat-related morbidity and mortality
- Morbidity and mortality from extreme events
- Cardiovascular and respiratory diseases (including hypertension, asthma and malnutrition).

23 CONCLUSIONS

- There will be increased intensity and/or frequency of extreme weather events:
  - Tropical cyclone intensity, storm surges, drought, extreme precipitation and heat waves.
- There will be large climate change-induced disruptions to oceanic and terrestrial ecosystems:
  - Temperature increases
  - Ocean acidification and reduced oxygenation
  - Loss of coral reefs
  - Pelagic fish stocks will collapse
  - Loss of agricultural productivity
  - Loss of shoreline, saltwater intrusion and inundation of settled and agricultural areas

CONCLUSIONS CONT.

- The impacts of climate change are already being felt in the Caribbean and will increase significantly by 2030.
- In the next 12 years, from a health perspective, the Caribbean will face, inter alia,:
  - Increased exposure to weather-related disasters
  - Increased vulnerability to diseases
  - Increased stress on freshwater supplies
  - Economic decline in vital sectors (e.g. tourism, agriculture, fisheries)
- By 2050, on the current emissions trajectory, all Caribbean islands and low-lying coastal states will experience significant population and infrastructure displacement.

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