Quantification and Magnitude of the Losses and Damages of Climate Change

Modelling the Transformational Impacts and Costs of Sea Level Rise in the Caribbean and extending analyses of the impacts and costs of climate change on a sectoral basis

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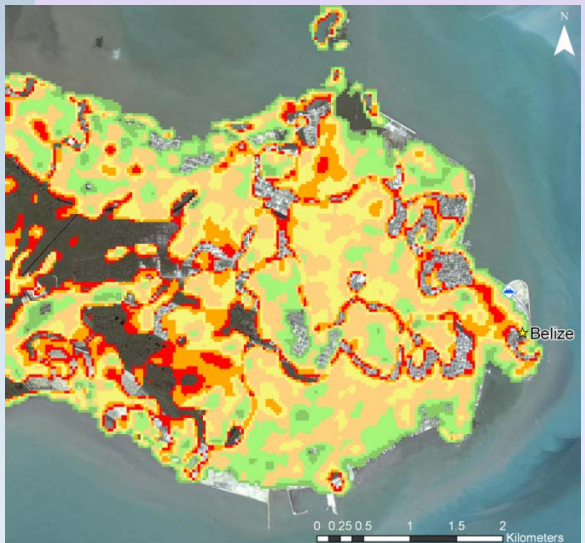


UNFCCC
Expert Meeting
Assessing Risk
of Loss and
Damage from
Climate Change
Tokyo
27 March 2012

Phase I > Phase II > Phase III:

- **Unique** (determining impacts)
- **Most Detailed to Date** (geographic and economic)
- **Robust** (analysis and costing of losses and damages)
- Anchored in intergovernmental processes; Builds and Extends: Phase I COP 15 / previous studies ECA / CCRIF / World Bank / SEI-Tufts / Phase II COP 16 / 17 (Risk Atlas) / 18
- **COP 18 / 19 = Phase III** – sectoral analysis; replicable (adaptive); national and local; inventories; support negotiation and adaptation
- **UNDP Barbados and the OECS -** CARICOM (and 5Cs)
- The CARIBSAVE Partnership and INTASAVE
- **Phase III – Caribbean, Pacific and Indian Ocean** national and local

Caribbean Climate Change Loss and Damage: Agriculture, Water and Ecosystem Services

- **Decrease the average yields** of three key crops by **3-8%** (irrigated and rainfed rice, rainfed maize and rainfed cowpea)

  Yield effects = agricultural value **fall between US $85 - $243 Mill p.a.**
- **Ecosystem services** (fisheries and tourism) provided by coral reefs in the Caribbean are valued at **US$ 1.5-3.5 billion/annum.** +2.0°C will rapidly degenerate the corals, resulting in ecosystems and $ Billions lost
- +1.5°C will severely impact **water resources** in a minority of CARICOM states, while **+2.0°C will severely impact the majority;** Decreased precipitation, reducing surface water reserves and groundwater recharge; drought; saltwater intrusion



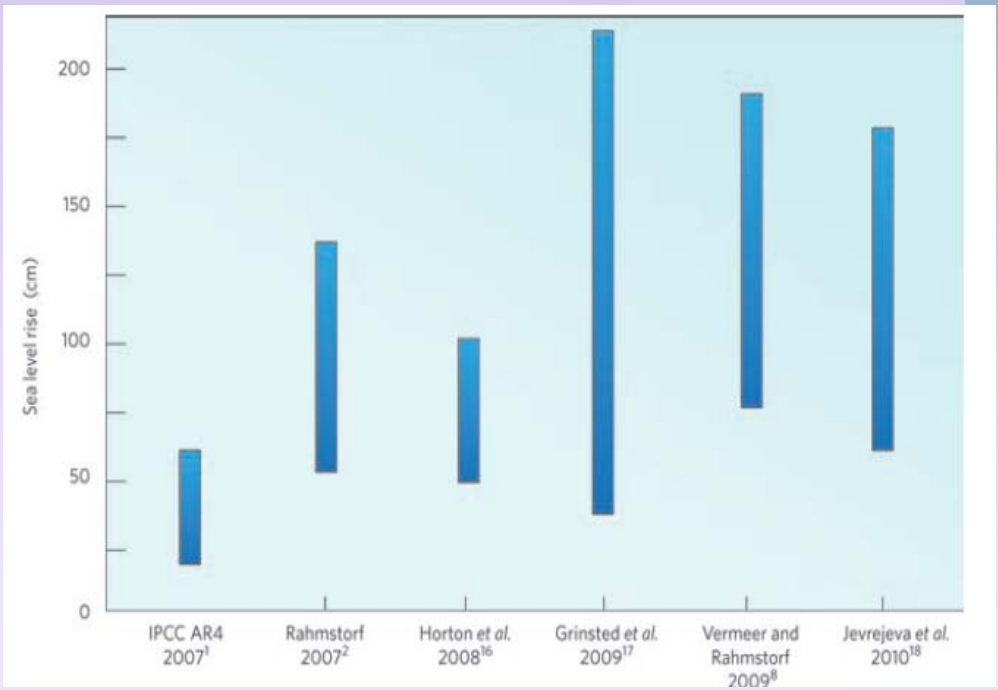
Advancements in Understanding the Consequences of Sea Level Rise (SLR) through use of:

- new **higher resolution geospatial data** coastal areas
- **improved inventories** of coastal infrastructure and assets at risk;
- quantification of the extent of **SLR-induced erosion risk**
- Comprehensive **combined SLR and Storm Surge (SS)** risk;
- quantification of the **extent and cost of structural protection** for protection of coastal cities;
- **Actuarial Approach** to costing losses and damages:
  consistent; replicable; robust; accepted by wide community

Global SLR Projections

- Moderate to high GHG emission scenarios pose a major **threat to the stability of the world's ice sheets**, introducing the possibility of rapid SLR on a decadal timescale up to 10x the rate observed a century ago

- Accounting for rapid ice sheet melt (Greenland & Antarctic), recent studies have supplanted IPCC projections and **forecast 1.5-2m SLR by 2100**
- Regardless of global temperature increases, **sea levels would continue to rise for many decades**

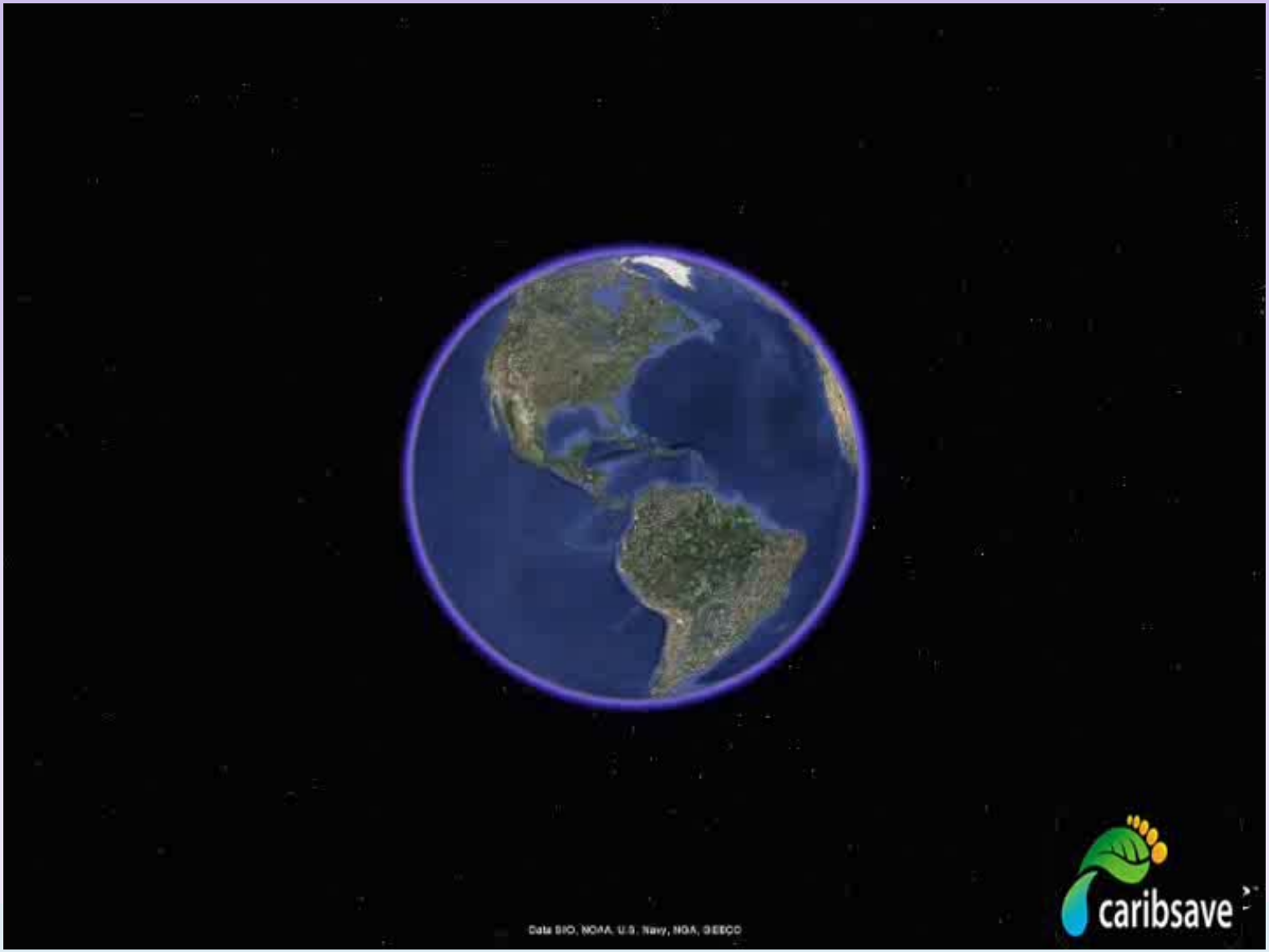


Caribbean SLR Projections

- Gravitational and geophysical factors will lead to the region being **more seriously affected by SLR** than most global areas
  - SLR in northern Caribbean may exceed global average by **up to 25%**
- **Impact of tropical storms and hurricanes** on coastlines, even at present levels, will be **intensified** as sea level rises
- SLR will continue for centuries after 2100, even if global temperatures are stabilized at 2.0 °C or 2.5°C






caribsave
Data SIO, NOAA, U.S. Navy, NGA, GEBCO
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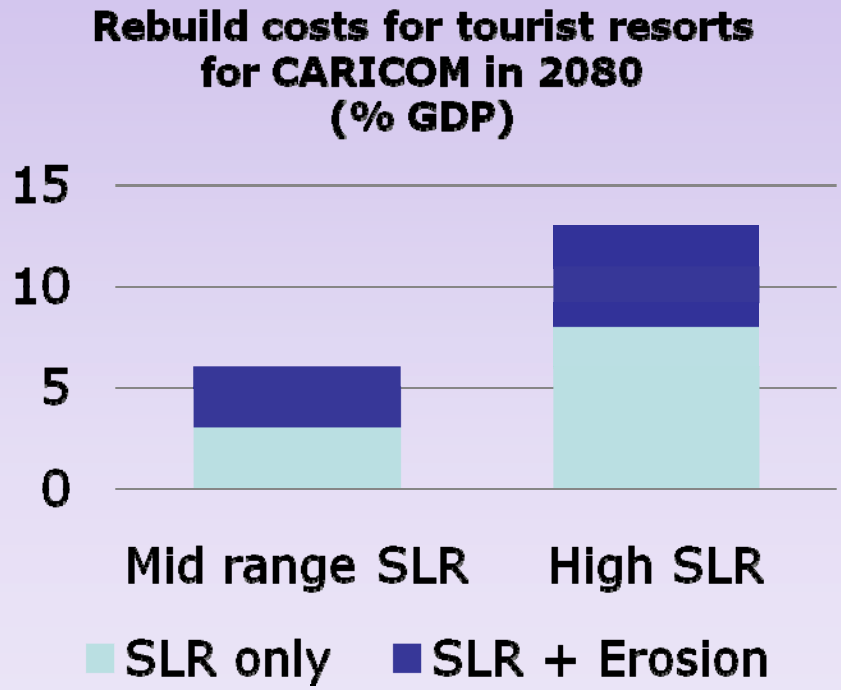
Impacts of Erosion on Tourism Sector

- For 1m SLR **erosion** of between **50m and 100m**

- Erosion amplifies impacts of SLR in all cases

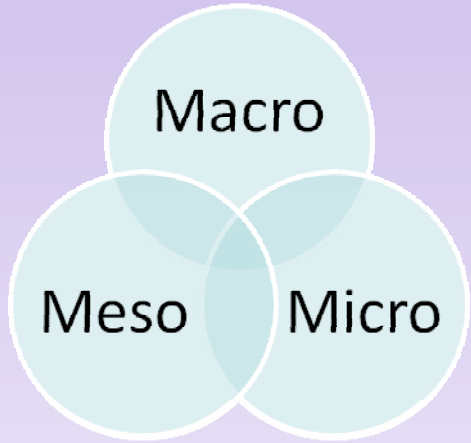
- **Example: Barbados**
  - **Costs projected to increase from US$945m to US$6.6bn[1]**



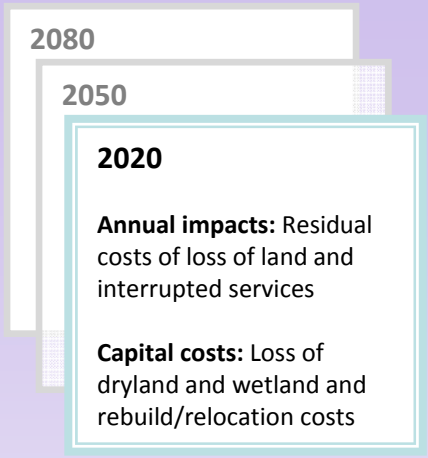
[1] mid range SLR scenario, 2080

Methodology for Economic Analysis

- Economic impacts of 1m to 2m SLR.
- Costs split into:
  - Annual costs
  - Capital costs
    - Rebuild costs
    - Asset value of land loss
- Further analysis of combined SLR and erosion



Analysis involved costing impacts at different scales



Macro
Evaluation of impacts at a state level

Macro scale analysis involves consideration of economic indicators and how these will be affected. Logically, and as much as is feasible, micro impacts are traced to the macro scale to allow loss to be described in terms of GDP loss. Application of country wide impacts is done on an aggregate basis. Costs are assumed to be proportional to the percentage of the sector impacted by the climate hazard.

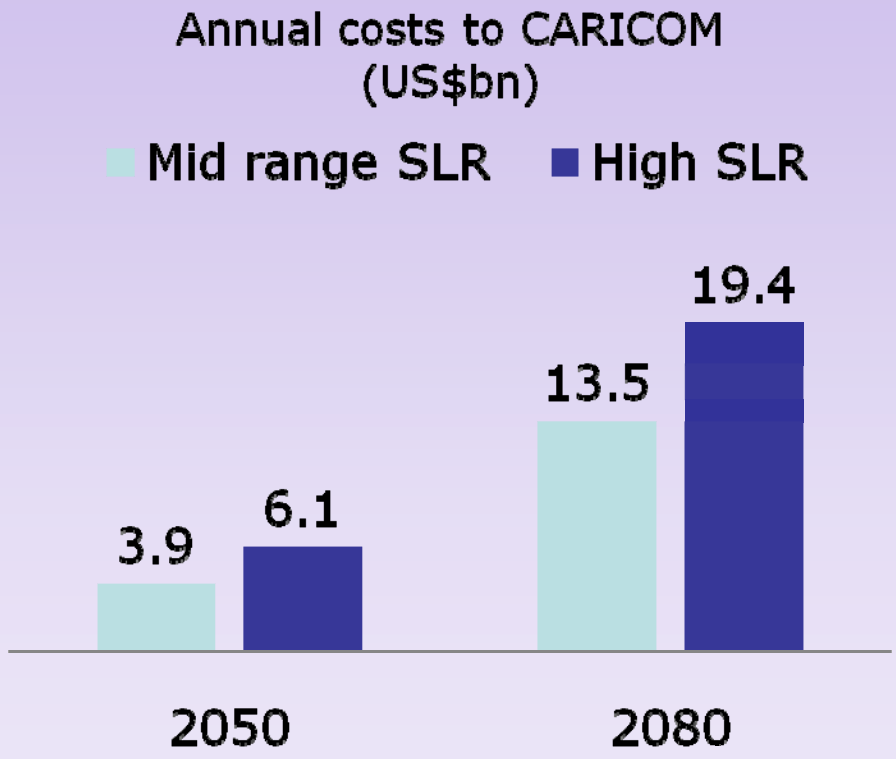
Aggregate impacts to country level

Micro:
Micro scale analysis takes place at the individual receptor level and is effectively a bottom-up approach to identify hazards and costs. It considers an individual element of an economy, for example a major port or individual property prices.

Meso:
Meso scale analysis involves investigating how impacts on one sector/city/region can affect other areas of the economy. Elements considered are major cities where GDP is concentrated, major ports and major industries.

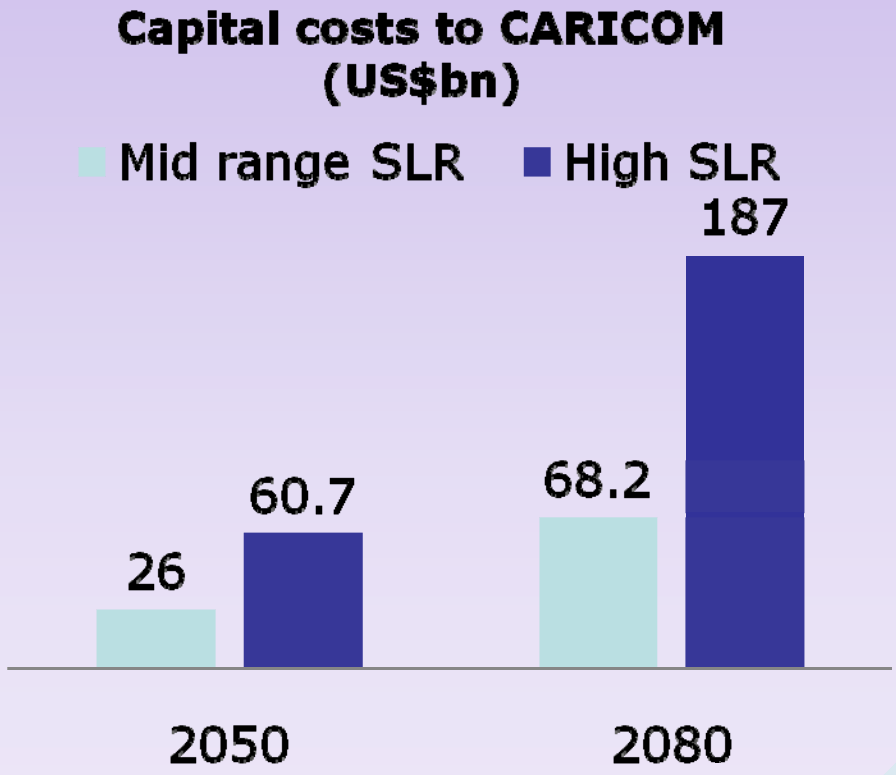
CARICOM Annual Impacts

- Impacts predominantly in tourist sector
- Agricultural sector of **Haiti** suffers greater than any other with annual costs of **US$650m to US$1.8bn in 2080.**



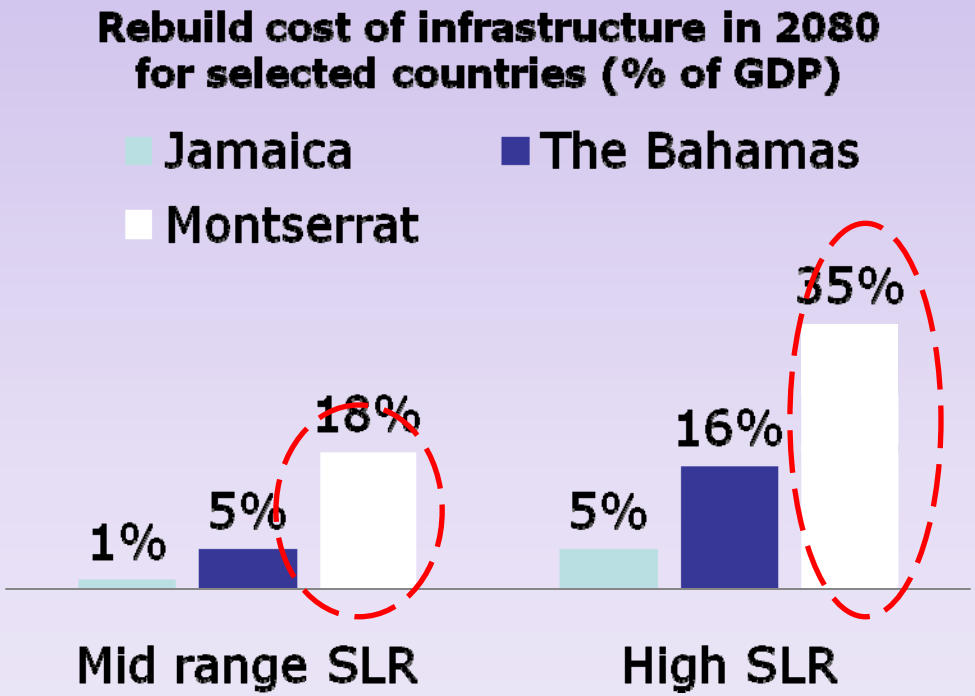
CARICOM Capital Costs

- **8.3% to 19.2%** of GDP in 2080
- Asset value of **land lost** projected to range from **US$31.7bn to US$64.7bn**
- Rebuild costs from **US$36.5 to US$122.2bn**



Example: Infrastructure Impacts

- Almost full port inundation of infrastructure in all CARICOM states for 1m SLR
- **Impacts disproportionate to GDP for small island states**



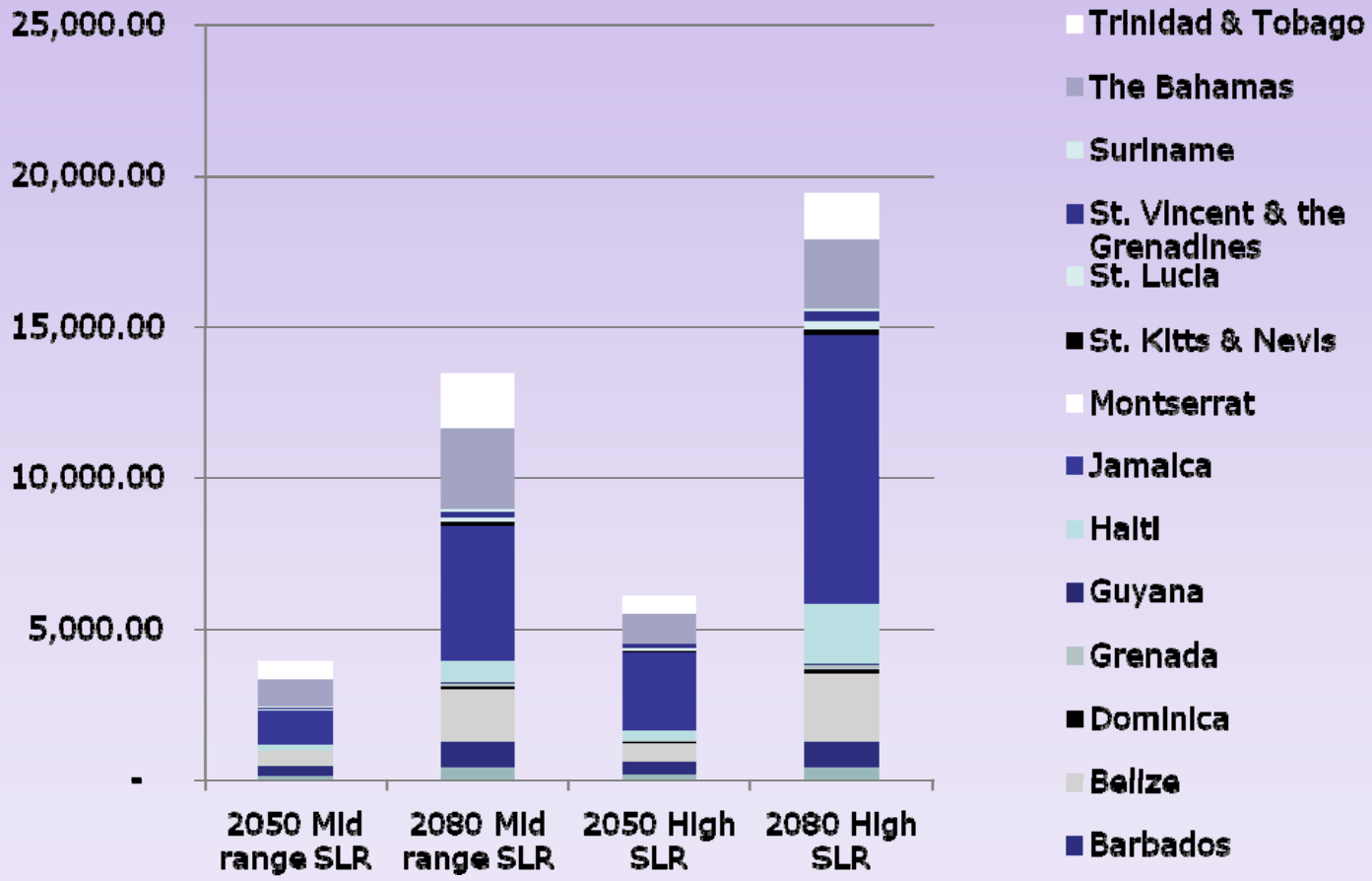
Total Annual and Capital Costs of SLR in CARICOM Countries*

	2050s		2080s	
	Annual Costs (US $ billion)	Capital Costs (US $ b)	Annual Costs (US $ b)	Capital Costs (US $ b)
Mid-Range SLR Scenario	3.9	26	13.5	68.2
High SLR Scenario	6.1	60.7	19.4	187

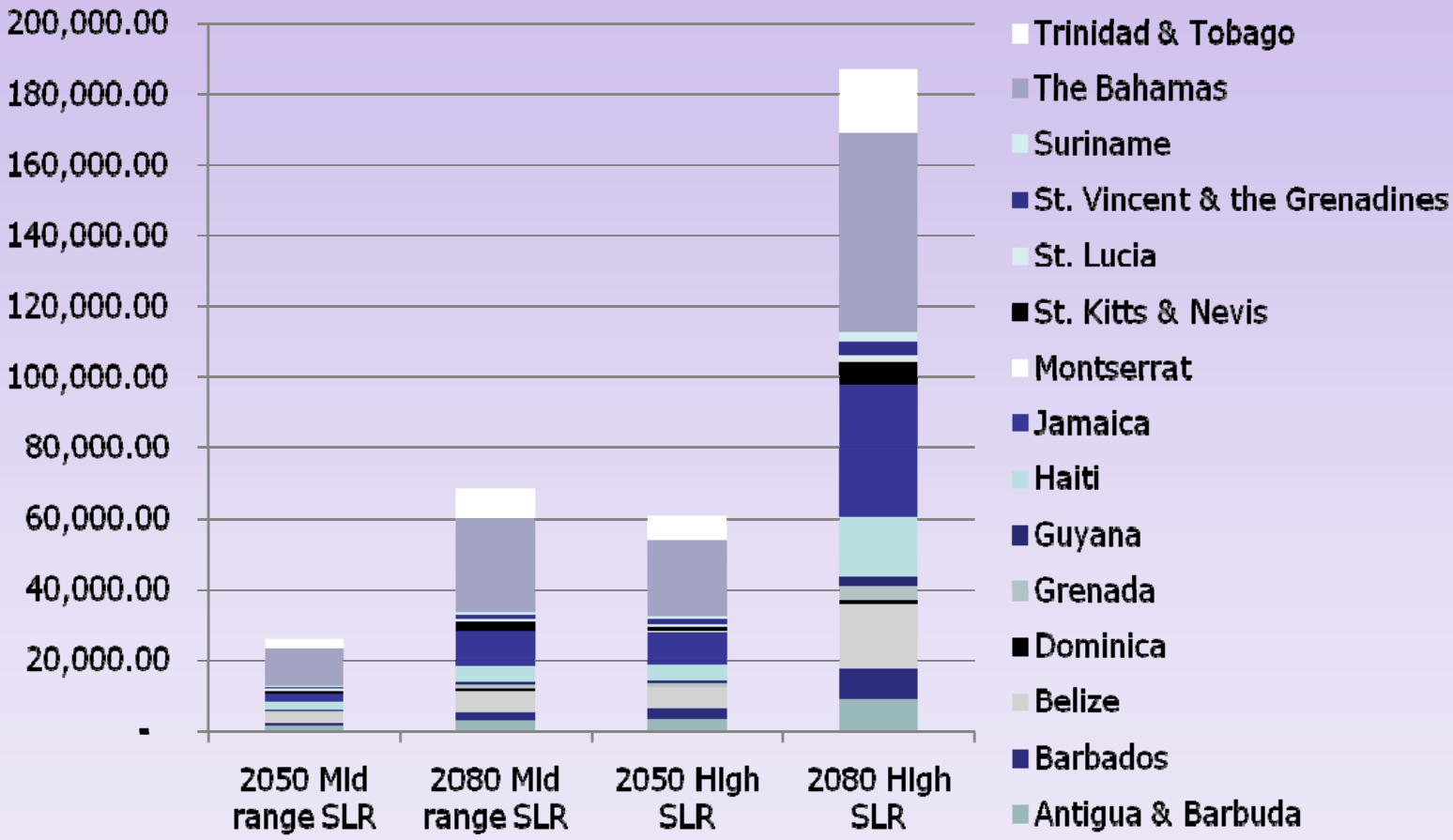
(in 2010 USD)

*Plus undeveloped land loss of $70 Billion

Annual Cost (US$million)



Capital Cost (US$million)



Key Findings

- Impacts of SLR significant for all states (average capital costs of up to **48% of GDP in 2080**)
- Rebuild costs **disproportionately high for smaller island** states
- Rebuild costs of tourist resorts very high in many cases (average of up to **28% of GDP in 2080**)
- **Key infrastructure** (ports, airport and power plants) in most countries **vulnerable** to 1m SLR
- Impacts increase significantly from 2050 to 2080

Key Findings

- Nearly **one-third** of major tourism resorts and airports are at risk to **1m SLR**
- A **large majority** of land around seaports, vulnerable to flooding from 1m SLR.
- **Geographic pattern of impacts** among the CARICOM nations remains **broadly similar** under a 2m SLR scenario; **magnitude** of impacts for the region as a whole and in the highly vulnerable nations was **far more pronounced**

Conclusions

- Projected SLR would be **transformational** to the economies of CARICOM and the Caribbean and other SIDS and coastal LDCs
- The **costs of damages** resulting from unprotected coastlines and the **costs of protecting** high-value urban coastlines and strategic infrastructure will have a **major impact** on individual communities and national economies of CARICOM, SIDS and coastal LDCs.
- **Significant barrier** to achieving Millennium Development Goals impeding pursuit of sustainable development more broadly

Selected Actions

1. **Improve the information base** and **adopt recommendations**
2. **Actions and policies for decision-makers** to develop a strategic adaptation response
3. **Cost-Benefit**, and similar i.e. Livelihoods, analysis and **socio-economic scenarios of adaptation strategies** urgently required
4. **Improve climate change predictions and down-scaling of climate change scenarios;** evidence-based decisions
5. **Predict impacts on key sectors**
6. **Improvement to spatial detail and resolution of data**

Actions > Phase III

1. **Build** on past + innovate – cost loss and damage; **improve negotiation and planning tools for adaptation strategies**
2. **Actuarial approach** to account for and value loss and damage; consistent, robust, replicable and widely accepted
3. **Multi-Sectoral Aspects to ensure meaning and relevance to national economies and livelihoods**: ecosystems services (coral); water; agriculture; tourism; coastal erosion / land loss
4. **Caribbean, Pacific and Indian Ocean (LDCs and SIDS)**
5. **National and Local Focus**
6. **Asset Inventories (database)** national and local **(LDCs and SIDS)**

THANK YOU

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www.caribsave.org

www.bb.undp.org