Urban Climate Change Research Network - UCCRN

An International Symposium

Columbia University, New York, NY
May 10-11, 2007

Panel Session:

Infrastructure Risks in Coastal Cities

Panel Members:

Klaus Jacob, Discussion Leader,	New York,	Columbia University
Richenda Connell,	London;	Acclimatize, Inc.
Claudia Natenzon,	Buenos Aires;	Universidad de Buenos Aires
Virginia Burkett,	New Orleans;	U.S. Geological Survey

What is Risk ?

Risk is the probability of future loss.

Since the loss occurs in the future, the loss (in time, location and magnitude) is uncertain, but we can estimate the losses, i.e. their expected magnitudes vs. probability (per unit time).

Risk to infrastructure is the probability (per unit time) of loosing some or all of the value and functionality of the infrastructure, by partial damage or total destruction, respectively.

What is Infrastructure?

Physically and functionally, infrastructure systems consist of interconnected networks of facilities that allow to deliver resources (water, energy, information); remove waste (solid, liquid); move people and goods; and create - to a large degree - the viability of cities. The degree to which *functioning* Infrastructure exists, distinguishes MDC from LDC, and - to a lesser degree - urban from rural regions.

Infrastructure provides the engineered foundation for the socio-economic functioning of population centers. Infrastructure may be publicly or privately owned, but serves the <u>common</u> good.

The robustness of infrastructure systems depends on design, state of maintenance, and on the human and natural stresses to which they are exposed. Besides usage-related stresses, weather, climate, and extreme natural events such as floods, earthquakes, and wind or ice storms test the vulnerability of these systems.

SYSTEM SENSITIVITY TO VARIOUS TYPES OF CLIMATE CHANGE

	CHANGE IN **MEAN** TEMPERATURE & PRECIPITATION	MORE **EXTREME** TEMP. & PRECIPI.	ACCELERATED **SEA LEVEL RISE**	MORE FREQUENT & SEVERE **STORMS**
TRANSPORT	**LOW** SURFACE MATERIALS & DRAINAGE DESIGN	**MEDIUM** SURFACE MATERIALS & DRAINAGE DESIGN AIRPORT RUNWAY LENGTH	**HIGH** ELEVATE, RELOCATE, LEVEES STORM BARRIERS	**VERY HIGH** STRENGTHEN, ELEVATE, RELOCATE, PROTECT
SEWER	**MEDIUM** MINOR CAPACITY INCREASE	**MEDIUM** INCREASE PEAK CAPACITY & RETENTION	**HIGH** REDESIGN, ELEVATE, REGRADE RELOCATE	**VERY HIGH** STRENGTHEN, ELEVATE, RELOCATE, PROTECT, INCREASE PEAK & RETENTION CAPACITY

SOME OBSERVATIONS:

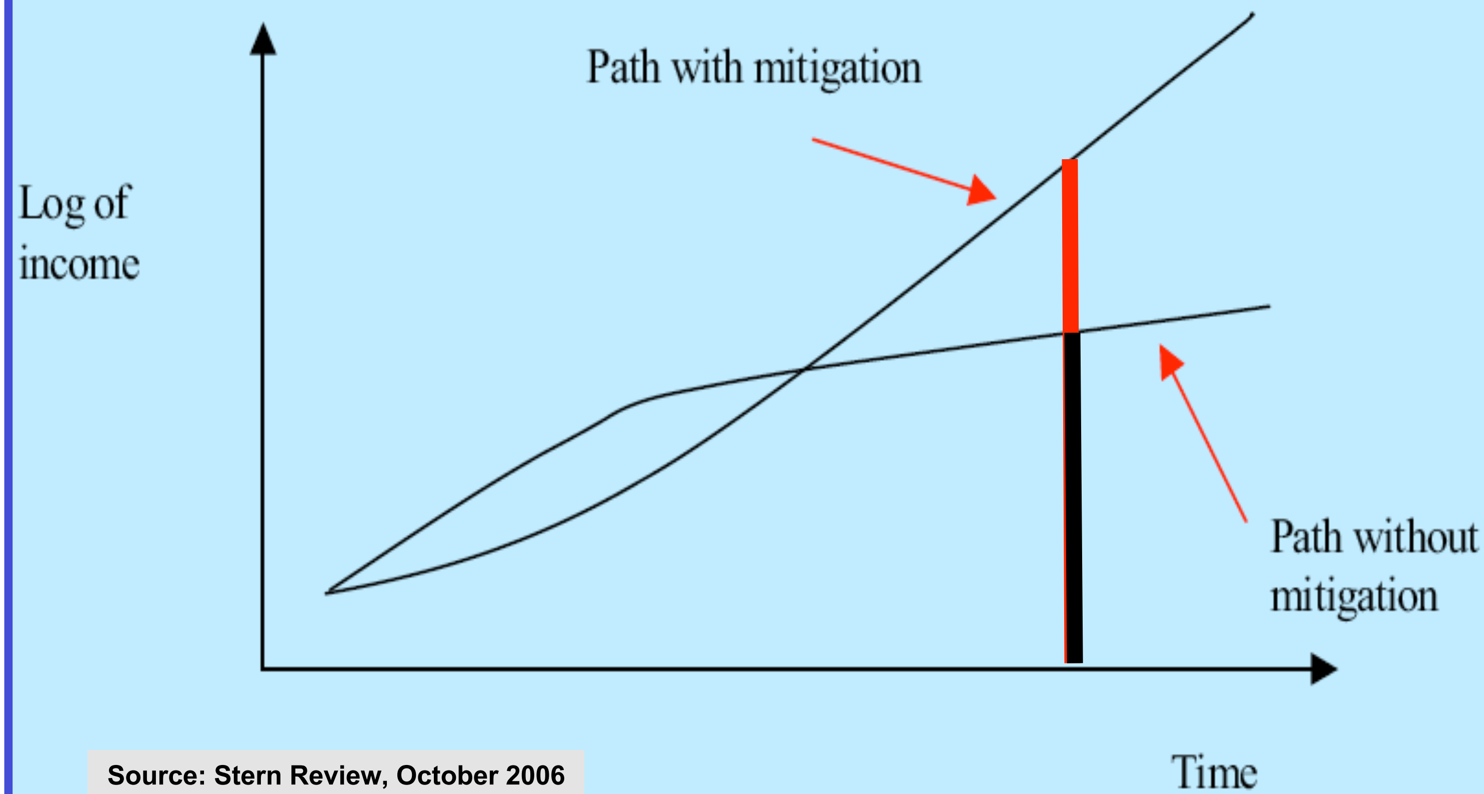
- Globally, NEW Infrastructure will be built largely in the emerging cities and countries, as they try to rid themselves from poverty.
- **Climate Change, and Sea Level Rise (SLR), Become Effective over Decades to Centuries.**
- Cities and Infrastructure (at least would like to) last for Centuries. => BEWARE OF SLR !
- **Thus: It is Wise to Plan NOW for FUTURE Climate Change when Infrastructure Capital Assets are Planned, Designed, Modified or Overhauled.**
- Without such Foresight:

Future Costs = Increased Adaptation Costs + Losses .

EXAMPLE: “Katrina” / New Orleans

Economics of Risk Management: a Penny of Precaution NOW, is Worth a Buck of AVOIDED FUTURE Losses.

Conceptual approach to comparing divergent growth paths over time



Source: Stern Review, October 2006

Risk Management Tools: Minimizing the Risk via **Risk** Mitigation or Adaptation **Measures** (Let's use the Risk Equation and GIS-based Models!) :

Risk = Sum (**Hazard x Assets** x Vulnerability)

Mitig.:	**Reduce GW + SLR Hazards**
Adapt.:	**Land Use Planning & Zoning,**
	Considerate Placements of new Assets,
	Relocation of Essential Assets.
	Levees & Dams (?).
	Equity Issues.

or by **Risk** = Sum (Hazard x **Assets x Vulnerability**)

Good Engineering, Construction Quality-Control,
Codes and Code Enforcement, Retrofitting,
Raising Assets in Place

CHALLENGE (to this UCCRN Panel):

Question:

Shall UCCRN (or IPC3) Strive Towards Formally Developing Adaptation Guidelines for Planning of New, and Upgrading of Existing Coastal Urban Infrastructure?

Example:

UCCRN May Want to Recommend Minimum Target Planning Elevations for Infrastructure Systems, above Current MSL (or local MHT); or may do so in Terms of *Local*-SLR Time-Horizons (50, 100, 200, 500, or 1000 Years ?).

Of the World's 25 Largest Urban Concentrations, 18 Cities (72 % by number, more by population) are at or near the Coast and have at least some Tidally controlled Waterways. Only 7 of the 25 Largest Cities (28%) are land-locked, albeit many on Rivers.

1. Tokyo, Japan - 28,025,000
2. Mexico City, Mexico - 18,131,000
3. Mumbai, India - 18,042,000
4. Sáo Paulo, Brazil - 17, 711,000
5. New York City, USA - 16,626,000
6. Shanghai, China - 14,173,000
7. Lagos, Nigeria - 13,488,000
8. Los Angeles, USA - 13,129,000
9. Calcutta, India - 12,900,000
10. Buenos Aires, Argentina - 12,431,000
11. Seóul, South Korea - 12,215,000
12. Beijing, China - 12,033,000
13. Karachi, Pakistan - 11,774,000
14. Delhi, India - 11,680,000
15. Dhaka, Bangladesh - 10,979,000
16. Manila, Philippines - 10,818,000
17. Cairo, Egypt - 10,772,000
18. Osaka, Japan - 10,609,000
19. Rio de Janeiro, Brazil - 10,556,000
20. Tianjin, China - 10,239,000
21. Jakarta, Indonesia - 9,815,000
22. Paris, France - 9,638,000
23. Istanbul, Turkey - 9,413,000
24. Moscow, Russian Fed. - 9,299,000
25. London, United Kingdom - 7,640,000

Today we hear from 3 of these Coastal Metro Areas (**New York, Buenos Aires, London**) and from **New Orleans** (with a pre-*Katrina* Population of almost 500,000)

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