

# Impacts of Climate Variability and Change on Urban Infrastructure



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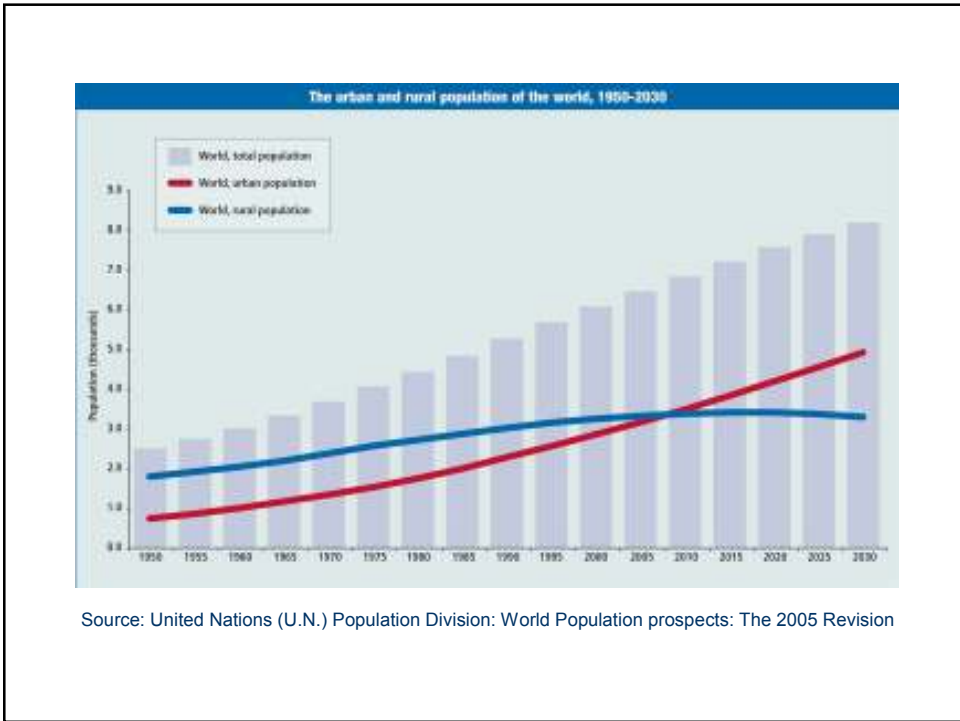
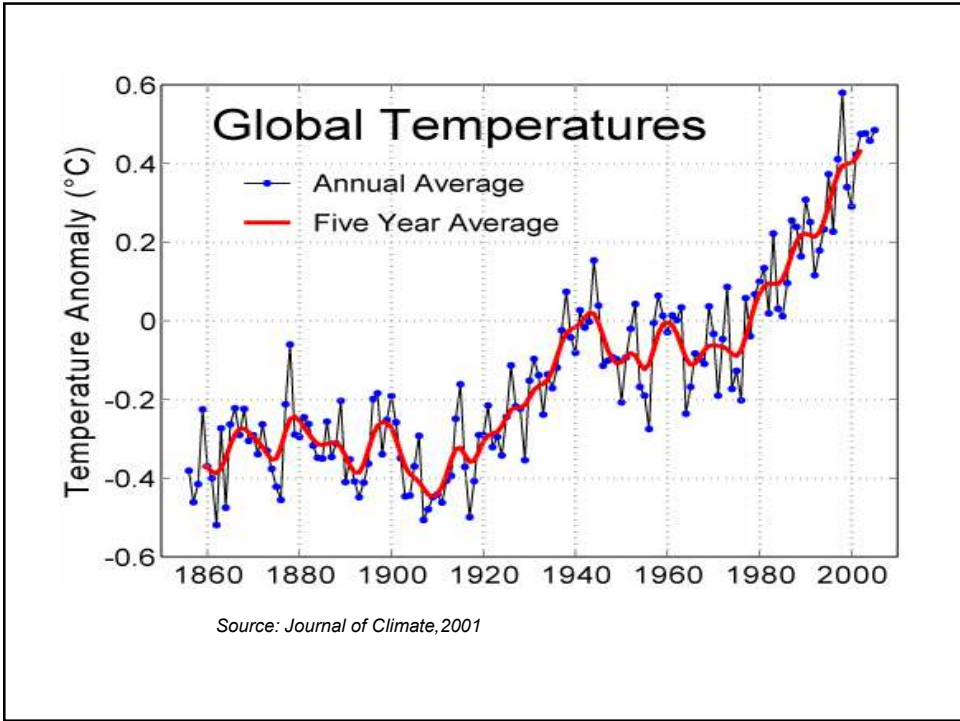
## Climate Change India 2008

22-23 April 2008, Hotel Le Meridien, Pune

## Background & Introduction

- Climate and Cities
  - Climate being constant
  - Climate shaping cities
  - Climate shaping buildings
- The Green House Effect
  - Natural Causes
  - Anthropogenic causes
  - Recent History of GHGs
- Global Warming & Climate Change
  - Temperature Increase
  - Sea Level Rise
  - Precipitation Change
- Urbanization
  - Rural v/s Urban
  - Population Density
  - Infrastructure Stress

Importance of Climate and Climate Change for Urban Development



## Why Urban Infrastructure?

1. Long-life assets (e.g. infrastructure) are essential to development.
2. Infrastructure systems are designed to meet climate conditions; if climate changes, their performances will change.
3. Huge investments are being committed in developing countries.
4. Most infrastructures are open assets and hence exposed to climate.
5. Urban Areas have the highest concentration of infrastructure systems and accumulated value.
6. Changes in urban systems are often the drivers for socio-economic change in a region.
7. Impacts on urban infrastructure systems may be way beyond the observed extent.
8. Infrastructures are not assessed for climate impacts and adaptation.
9. Infrastructures have low autonomous adaptive capacity.
10. Infrastructures are also part of adaptation strategies.

Studies related to Impacts on Urban Infrastructure provide a research opportunity

## Climate Change and Urban Infrastructure

1. Existing Stresses on Urban Infrastructure.
2. Possibilities of inherent vulnerability of the urban areas.
3. Possibilities of direct and indirect impacts of climate change.

## Studying Impacts of Climate Change

1. Climate Change manifests itself in different ways.
2. Various Infrastructures have different inherent qualities.
3. Different sector of urban infrastructure requires separate analysis for impacts and adaptations.
4. Appropriate tools should be used to analyze the likely impacts.
5. Identification of the Adaptation possibilities to reduce Vulnerability.

## Urban Infrastructure

1. Transportation system
  - Railways, Roadways, Waterways and airways.
2. Sewage and Drainage system
  - Sewage carriage network, Treatment plants, Recycling plants, Rain water disposal network and natural runoff.
3. The Water supply system
  - Source of raw water, transportation system, Treatment plants and supply network.
4. The Energy system
  - Generation plants, Transportation system, supply network.
  - Refineries and distribution.
5. The built infrastructure
  - Public buildings, Private buildings, Heritage buildings,
  - Tourist attractions, Parks, open areas, play fields, Parking lots & Community gathering points

## Approaches

- Sectoral studies
- Few Impact studies
- Very few Adaptation Studies
- Regional diversity and Geographical differences
- Limited economic indicators of damages and costs

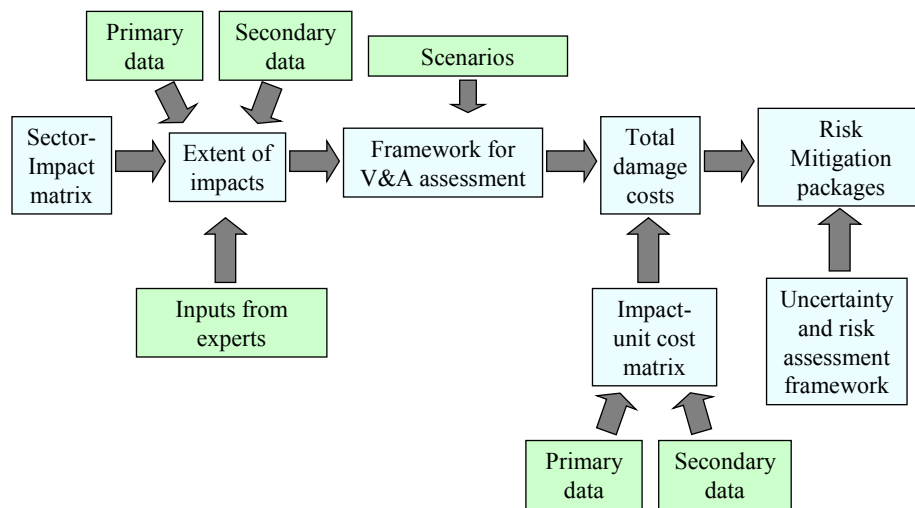
## Limitations of Approaches

- Limited capability to characterize and parameterize long term interactions between the economy, society, and environment
- Assumptions derived from developed world perspective
- Inability to characterize discontinuities and extreme events
- Weak behavioral interfaces
- Distance between analysts and policy makers

## Developing Country Problems

- Weak modeling and assessment capabilities
- Inadequate databases
- Transitions that rapidly change structure of the economy
- Multitude and conflicting developmental concerns
- Weak regional and international linkages
- Lack of sustained funding

## Analytical Framework



# Uncertainties

## Geographic factors

- Monsoons
- Sea level
- Water resources

## Socio-economic factors

- Population growth
- Urbanization
- Economic and social development

# Characteristics of impacts

- Impact are more directly associated with climatic extremes rather than averages.
- Possibility of abrupt climate changes not anticipated by normal response planning
- Substantively different for relatively developed, industrialized regions vs. less developed regions.
- Negative impacts of climate change pose risks of higher economic damages in developed / industrialized areas but higher human damages in less-developed areas.

# Assessment Framework

Future impacts on a system = fn. (SDVi, CCVj, SCVk)

where,

SDV = Projections for relevant Sustainable Development Variables

l = Technology, institutions (e.g. for governance and implementation),  
economic instruments (e.g. insurance etc), other policies  
(e.g. forestation, intensive cropping etc.)

CCV = Projections for relevant Climate Change Variables

j = Temperature, rainfall, sea level rise, extreme events, secondary  
variables

(e.g. vegetation, land slides, water logging, snowfall etc)

SCV = Projections for relevant System Condition Variables

k = Life, maintenance levels, usage patterns, soil type etc.

*Source:* From climate change impacts to adaptation: A development perspective for India,  
Amit Garg, P. R. Shukla and Manmohan Kapshe, Natural Resources Forum 31  
(2007) 132–141

# Adaptation Strategies

## Infrastructure

- Facilities and linkages against extreme weather-related events
- Contingency planning (such as stockpiling)
- Changes in financial mechanisms to increase resiliency
- Increased efficiencies in thermal conditioning
- Relocation and industrial restructuring
- Planning for likely increase in energy demands
- Rain water harvesting and water conservation.
- Attention to the security of transportation and other linkage infrastructures

## Conclusions: Climate and Infrastructure

- Long life assets having low autonomous adaptive capacity are vulnerable to environmental and climatic changes
- Impacts are location specific and are significant in long term and hence are often ignored in short-term assessments.
- Assessment of Level of exposure to climate change impacts
- Adaptation of long-term assets needs to begin early
- More studies needed on economic indicators of damages and costs
- Technological measures, economic instruments (*e.g. insurance*) as well as development strategies are vital for adaptation
- Many infrastructure projects are also elements of adaptation strategy (*e.g. hydro dams, river-linking projects, roads*) and impacts on these could be adverse to adaptation
- Development of an analysis framework to work as broad guideline with flexibility to accommodate situation specific changes
- Incorporation of adaptation approaches in development processes for effective implementation

Thank You ...