

## *Women's action towards climate resilience for urban poor in South Asia*



# CLIMATE CHANGE: IMPACTS ON INDIAN CITIES AND INFORMAL SETTLEMENTS

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## Global Impacts

*According to the Synthesis Report for Policymakers of the Intergovernmental Panel on Climate Change (the IPCC's Fifth Assessment Report at p. 2):*

“Anthropogenic greenhouse gas emissions have increased since the pre-industrial era, driven largely by economic and population growth, and are now higher than ever. This has led to atmospheric concentrations of carbon dioxide, methane and nitrous oxide that are unprecedented in at least the last 800,000 years. Their effects, together with those of other anthropogenic drivers, have been detected throughout the climate system and are extremely likely to have been the dominant cause of the observed warming since the mid-20th century.”

The report further presents consequences of this warming, including a decrease in cold temperature extremes, an increase in warm temperature extremes, an increase in extreme high sea levels, and an increase in the number of heavy

precipitation events in a number of regions (p. 7). Climate change will consequently amplify existing risks and create new risks for natural and human systems. The report further finds that these risks are unevenly distributed and are generally greater for disadvantaged people and communities in countries at all levels of development (p. 13). While the report finds several pathways to limiting global warming to 2o C above pre-industrial levels, it also finds that these pathways pose substantial technological, economic, social and institutional challenges, which increase with delays in additional mitigation and if key technologies are not available (at 20).

### Impacts on India

With more specificity in Chapter 24 of Working Group 2's Climate Change Impacts, Adaptation and Vulnerability report on Asia, the IPCC finds that impacts on human settlements in South Asia, particularly India, are already observable and well documented, including changes in major river runoff, reduction of permafrost, impacts on

floodplains, coastal areas, and infrastructure; health effects of floods and water-borne diseases. The health impacts of heat and drought are less well-documented but believed to be significant.

Considerably more information is available through the World Bank's 2013 study of the likely impacts of temperature increases from 2°C to 4°C in three regions. The World Bank commissioned the Potsdam Institute for Climate Impact Research and Climate Analytics to look at the best available evidence and supplemented it with advanced computer simulations to arrive at likely impacts on agriculture, water resources, cities and coastal ecosystems in South Asia, South East Asia and Sub-Saharan Africa. Of particular concern to this project, impacts on India are expected to include:

1. **Rainfall:** A decline in monsoon rainfall since the 1950s has already been observed. The frequency of heavy rainfall events has also increased. A 2°C rise in the world's average temperatures will make India's summer monsoon highly unpredictable. At 4°C warming, an extremely wet monsoon that currently has a chance of occurring only once in 100 years is projected to occur every 10 years by the end of the century. An abrupt change in the monsoon could precipitate a major crisis, triggering more frequent droughts as well as greater flooding in large parts of India. India's northwest coast to the southeastern coastal region could see higher than average rainfall. Dry years are expected to be drier and wet years wetter.
2. **Droughts:** Evidence indicates that parts of South Asia have become drier since the 1970s with an increase in the number of droughts. Droughts are expected to be more frequent in some areas, especially in North Western India, Jharkhand, Orissa and Chhattisgarh.
3. **Groundwater:** Even without climate change, 15% of India's groundwater resources are overexploited. Although it is difficult to predict future ground water levels, falling water tables can be expected to reduce further on account of increasing demand for water from a growing population, more affluent lifestyles, as well as from the service sector and industry.

*Field feedback in Bhopal: Access to well water during the summer used to occur at 20-25 feet. Now this access point has reached 80-100 feet, and specifically in the Daulatpura area, water access is available only at 250 feet.*

*Feedback in Ahmedabad: The water supply lasts for 2-3 hours a day in the Nakdanpura and Saraniyavas neighborhoods. The availability of water is a major issue, and as a result water must be collected from sources 1-2 km away, and often women have to fight for the limited supply.*

*Source: Community Focus Group Discussion (March 2015)*

4. **Glaciers:** Glaciers in the North Western Himalayas and in the Karakoram Range — where westerly winter winds are the major source of moisture — have remained stable or even advanced. On the other hand, most Himalayan glaciers — where a substantial part of the moisture is supplied by the summer monsoon — have been retreating over the past century.
5. **Water security:** An increase in variability of monsoon rainfall is expected to increase water s in some areas. Studies have found that the threat to water security is very high over Central India, along the mountain ranges of the Western Ghats, and in India's North Eastern states.
6. **Extreme heat:** India is already experiencing an increase in extreme heat events. Unusual and unprecedented spells of hot weather are expected to occur far more frequently and cover much larger areas. Under 4°C warming, the west coast and southern India are projected to shift to new, high-temperature climatic regimes with significant impacts on both cities' agriculture.
7. **Sea level rise:** The sea is expected to rise between a .4 - .75 m increase. The Goa-based National Institute of Oceanography (Unnikrishnan et al., 2007) found that the mean sea-level-rise along the Indian coast was about 1.3 mm per year. The last 113 years of tide data indicate that Mumbai witnessed a 0.77 mm per year rise. Mumbai has the world's largest population exposed to coastal flooding, with large parts of the city built on reclaimed land, below the high-tide mark. Rapid and unplanned urbanisation further increases the risks of sea water intrusion.
8. **Disease:** a resurgence of several vector-borne diseases long thought to be 'controlled'. Environmental epidemiologists blame the resurgence of some vector-borne diseases in India such as malaria, dengue and chikungunya.

Figure 1. Summary of climate impacts and risks in South Asia (World Bank, 2013, p. 107)

Row/Impact	Observed Vulnerability of Change	Around 1.5°C (2030s)	Around 2°C (2040s)	Around 3°C (2060s)	Around 4°C (2080s)
<b>Regional warming</b>	2011 Indian temperature 9th warmest on record, 2009 warmest at 0.9°C above 1961-90 average		Warm spells lengthen to 20-45 days. Warm nights occur at frequency of 40 percent		Warm spells lengthen to 150-200 days. Warm nights occur at frequency of 85 percent
<b>Heat extremes (in the Northern Hemisphere summer)*</b>	Unusual heat extremes	Virtually absent	15 percent of land	>20 percent of land	>70 percent of land in south almost all summer months unusually hot
	Unprecedented heat extremes	Absent	Virtually absent	<5 percent of land	>40 percent of land
<b>Precipitation (including the monsoon)</b>	Decline in South Asian monsoon rainfall since the 1950s but increases in frequency of most extreme precipitation events	Change in rainfall uncertain	Change in rainfall uncertain; 20 percent increase of extreme wet day precipitation share of the total annual precipitation <sup>†</sup>	About 5 percent increase in summer (wet season) rainfall	About 10 percent increase in summer (wet season) rainfall. Intra seasonal variability of monsoon rainfall increased, by about 15 percent. 75 percent increase of extreme wet day precipitation share of total annual precipitation <sup>†</sup>
<b>Drought</b>	Increased frequency short droughts			Increased drought over north-western parts of the region, particularly Pakistan	Increased length of dry spells measured by consecutive dry days in eastern India and Bangladesh
<b>Sea-level rise above current:</b>	About 20 cm to 2010	30cm-2040s 50cm-2070 70 cm by 2080-2100	30cm-2040s 50cm-2070 70cm by 2080-2100	30cm-2040s 50cm-2060 90cm by 2080-2100	30cm-2040s 50cm-2060 105cm by 2080-2100, Maldives 10cm higher

\* A more comprehensive table of impacts and risks for SEA is presented at the end of Chapter 5.  
 \* Years indicate the decade during which warming levels are exceeded in a business-as-usual scenario exceeding 4°C by the 2080s.  
 \* Mean across climate model projections is given. Illustrative uncertainty range across the models (minimum to maximum) for 4°C warming are 70-100 percent for unusual extremes, and 30-100 percent for unprecedented extremes. The maximum frequency of heat extreme occurrence in both cases is close to 100 percent, as indicator values saturate at this level.  
 † 50 percent uncertainty range 8-12 percent.  
 † 50 percent uncertainty range 65-85 percent.

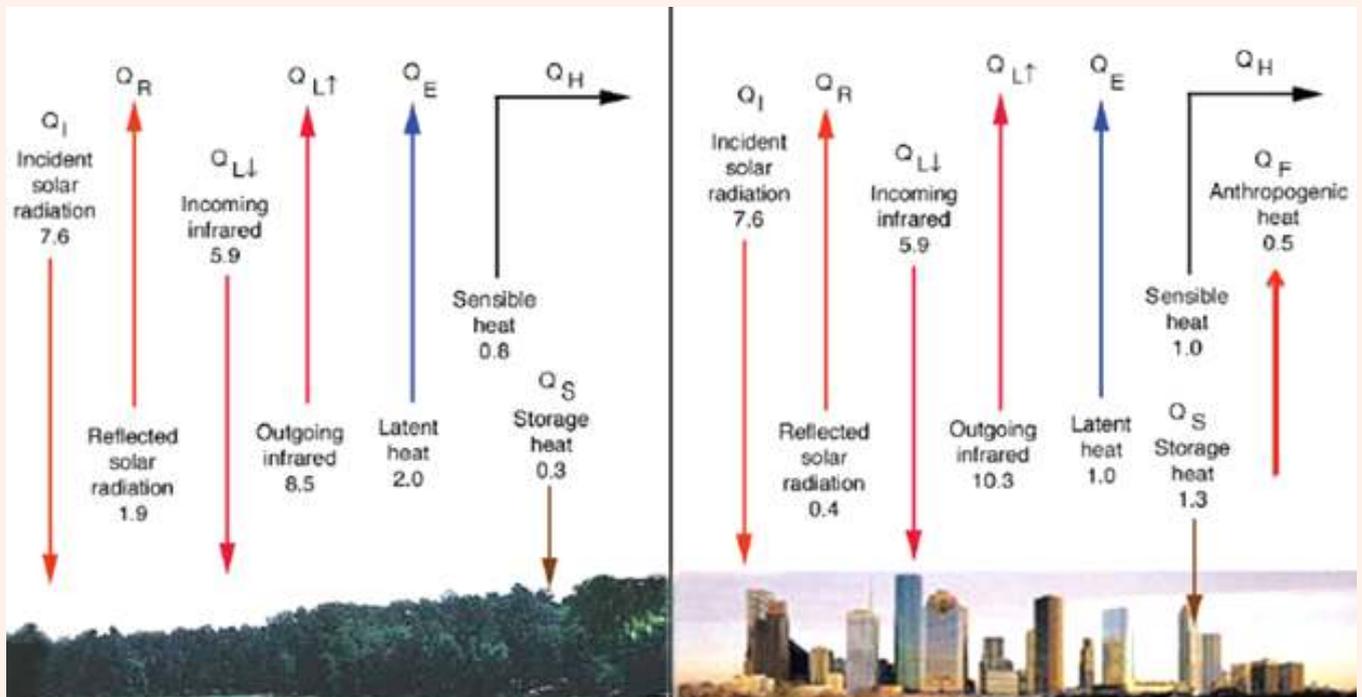
## Impacts on Indian Cities

The population of India is rapidly urbanising. While India was only 17% urbanised in 1950, it is now 30.9% urbanised and is projected to be 51.7% urbanised by 2050 (United Nations, 2011).

As a consequence, climate change impacts on

extreme heat events will be aggravated by increases in urbanisation and the related urban heat island effect. As cities displace forests and irrigated agricultural land, temperatures increase due to shifts in albedo and reflectivity of the land, alteration of the solar and infrared spectrum of outgoing radiation, shifts in latent and sensible heat profiles, and changes in heat storage.

Figure 2. Impact of Urbanization on Temperature (Stone 2012, 2015)



India's largest cities are now home to an estimated 18 million people, with Delhi and Mumbai having more than doubled in size and population in the past 25 years. Preliminary findings from the Delhi-based Energy and Resources Institute (TERI) show that temperatures in both cities have risen 20-30 C in only 15 years.

The ongoing study, based on NASA satellite readings, also shows the cities to be 50-70 C warmer than in the surrounding rural areas on summer nights (Vidal and Pathak, 2013). As a result of this, extreme heat events and their corresponding impact on human health are considerably worse in informal settlements located in cities than that for their corresponding communities in rural regions.

## References

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*"Mahila Housing SEWA Trust (MHT) aims to build capacities of women from slum communities to take lead in resilience action against heat stress, extreme precipitation events, water scarcity and contamination and vector borne diseases. The proposed community based resilience model will be women-led, integrated; evidence based, and will focus on innovative communication strategies to promote a culture of resilience action."*