Water Security in Peri-Urban South Asia

Adapting to Climate Change & Urbanization

July 26, 2012

Centre for Regional Studies, School of Social Sciences

Hyderabad Central University

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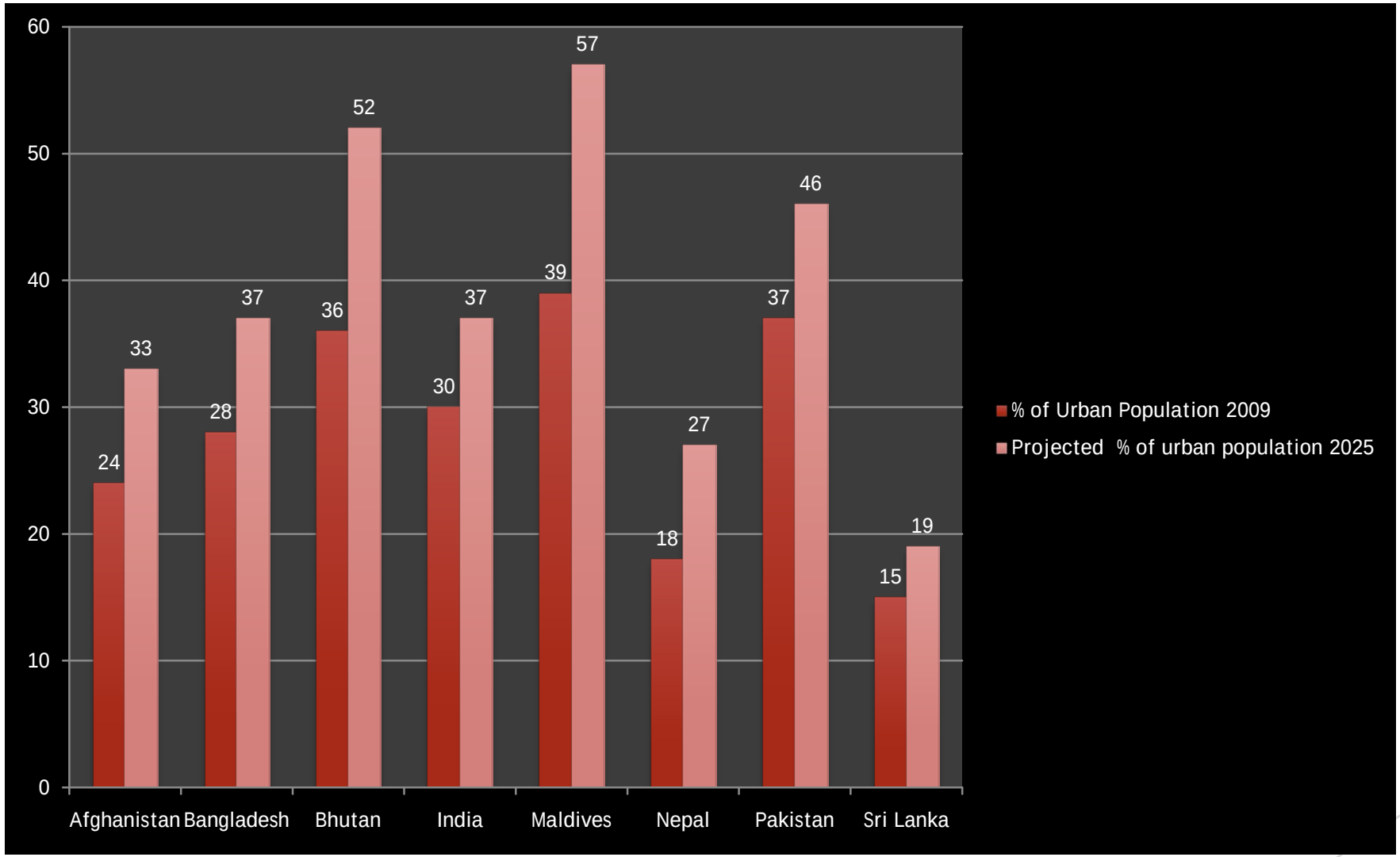
10 years 2002 to 2012

The Context: Urbanization in South Asia



Source: Economic and Social Commission for Asia and Pacific, 2009

Implications of Urbanization on water use and access

- Land acquisition changes water access
- Land use change alters demand for water
- Water sources filled up and acquired for urban purposes
- Polluting industries relocated to peripheries
- Urban commons get diverted for construction purposes- poor and landless suffer

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Conceptual issues in defining periurban

- Confusing term with no consensus regarding its meaning
- Used to denote a place
  - Fringe areas around cities
  - Rural areas, but also urban areas away from the core
- Process
  - Transition from rural to urban
- Concept/analytic construct
  - To study rural-urban relationships

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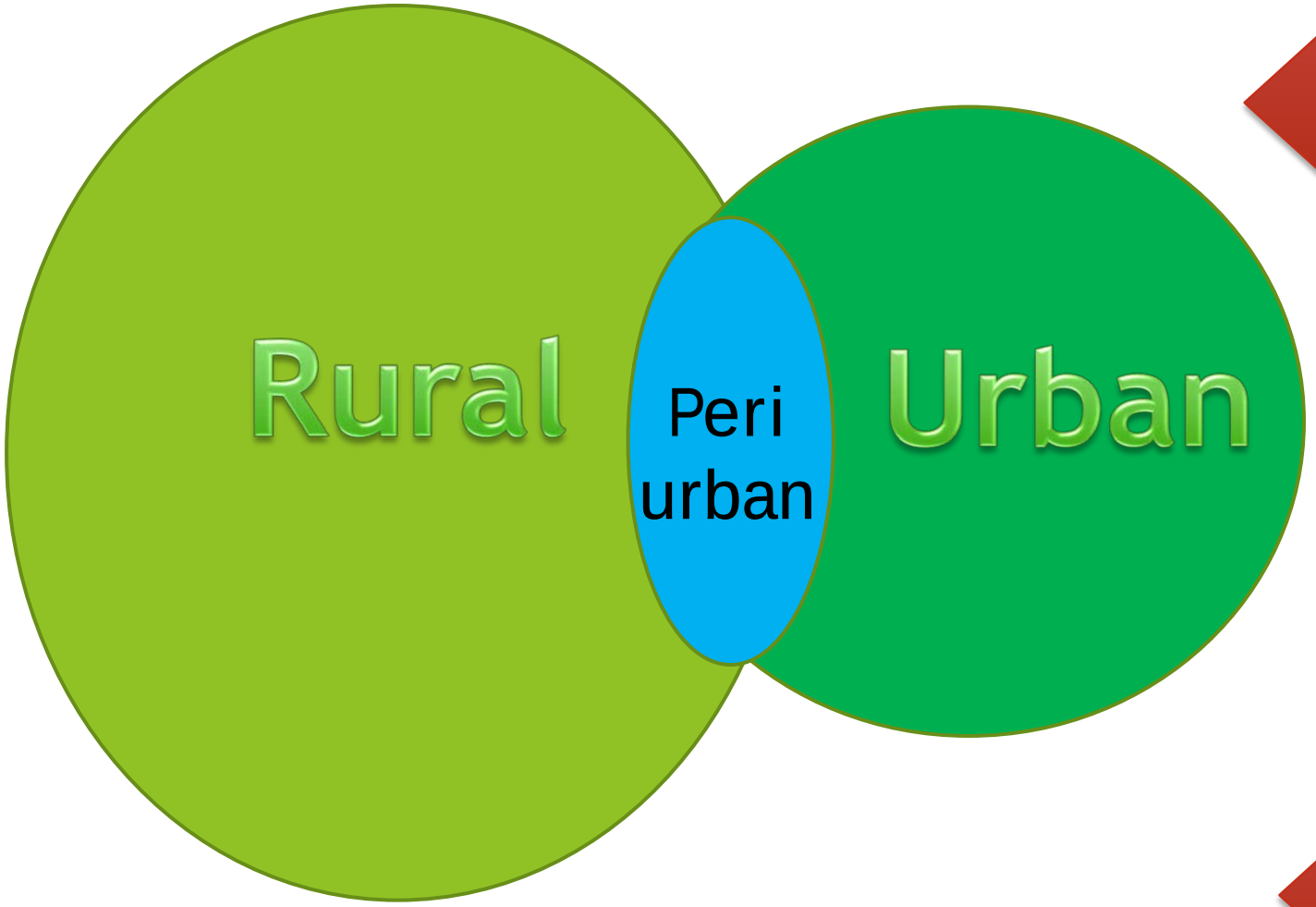
What is Periurban?



Geographical space between urban & Rural

Analytical construct of relationships

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Counterparts of periurban in other languages

Dutch	• *halfstedig (*semi-urban)
East Asia	• *'desakota' (city village)*
German	• *urban landlichen zonen* (urban rural zones)
Afrikaans	• *buitestedelik* (outer city or beyond the city)

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How we defined periurban?

- In terms of a process, concept and features rather than a fixed geographical space around the city

- Identified by a ‘periurbanscape’
  - Changing land use from rural to urban
  - Social transition and heterogeneity
  - Periurban livelihoods across rural and urban resources and assets
  - Flows of goods and services between rural and urban areas
  - New claimants on water and new rural-urban water flows

- periurban as a conceptual lens to study rural-urban relationships and flows of water

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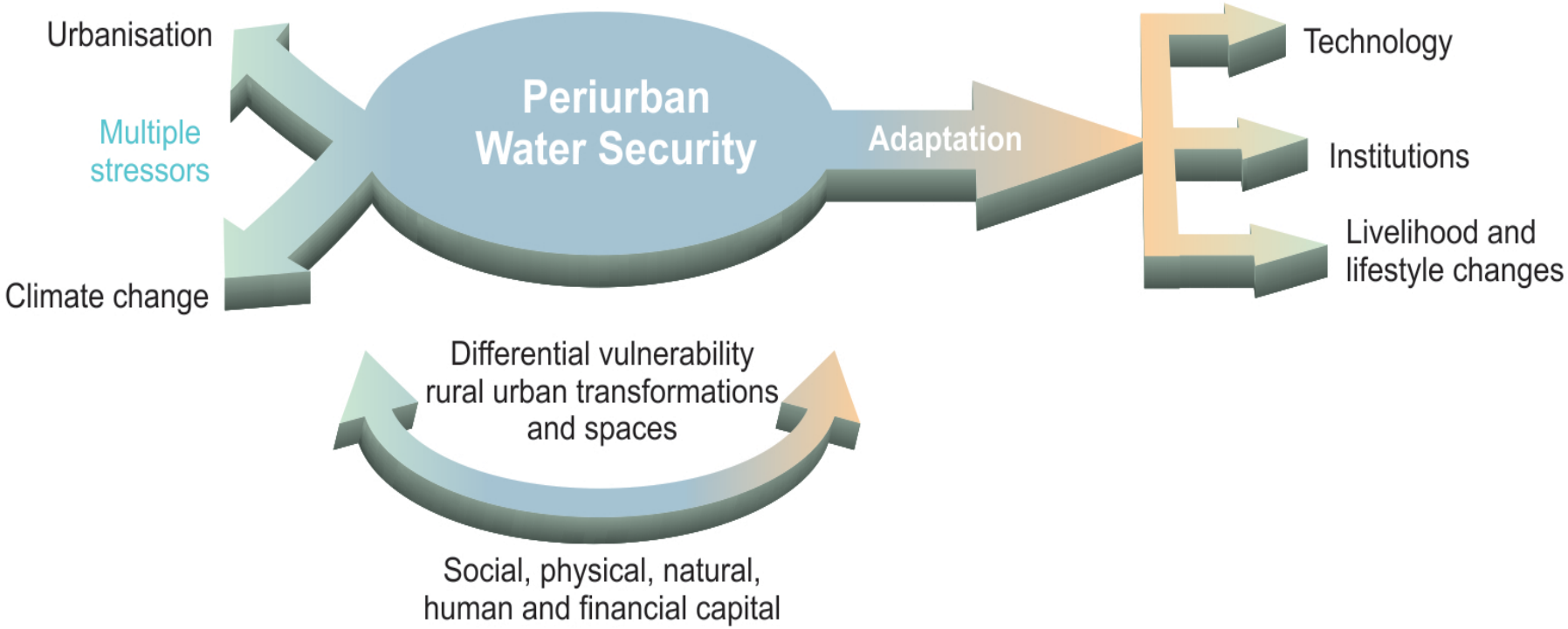
The conceptual framework



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Periurban water security

- growing pressure on local groundwater resources
- physical flows of water from the periurban area to cities
- contamination of periurban water resources by industries
- acquisition of village land and water sources to support urban expansion

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What constitutes water insecurity in peri-urban areas?

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Urbanisation & periurban water

Mismatch between urban planning and environmental planning

- D…
- …GW table
- …gal sand mining due to rise in construction
- Degradation of rivers\rivulets
- Thriving tanker economy

…mandu

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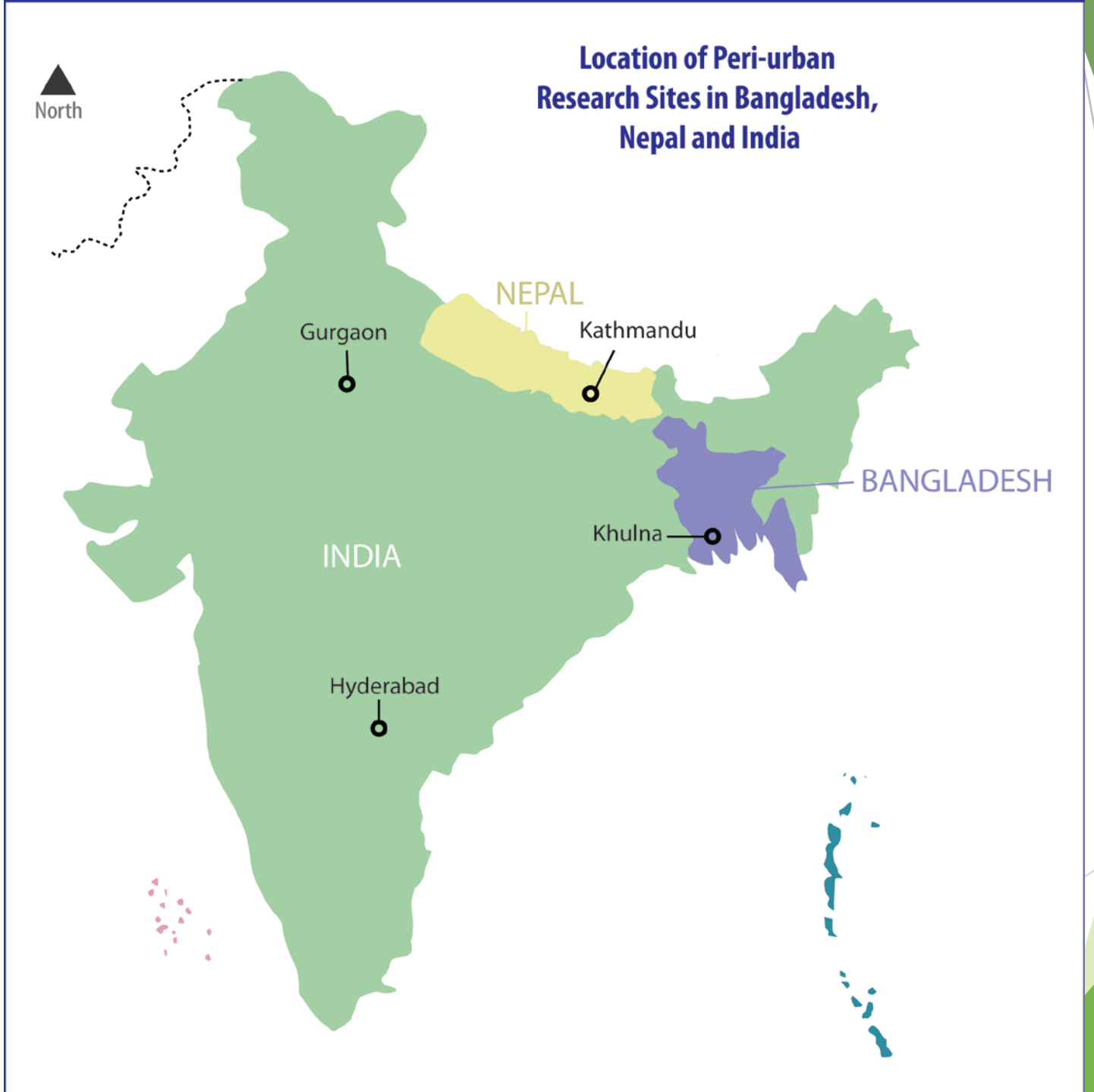
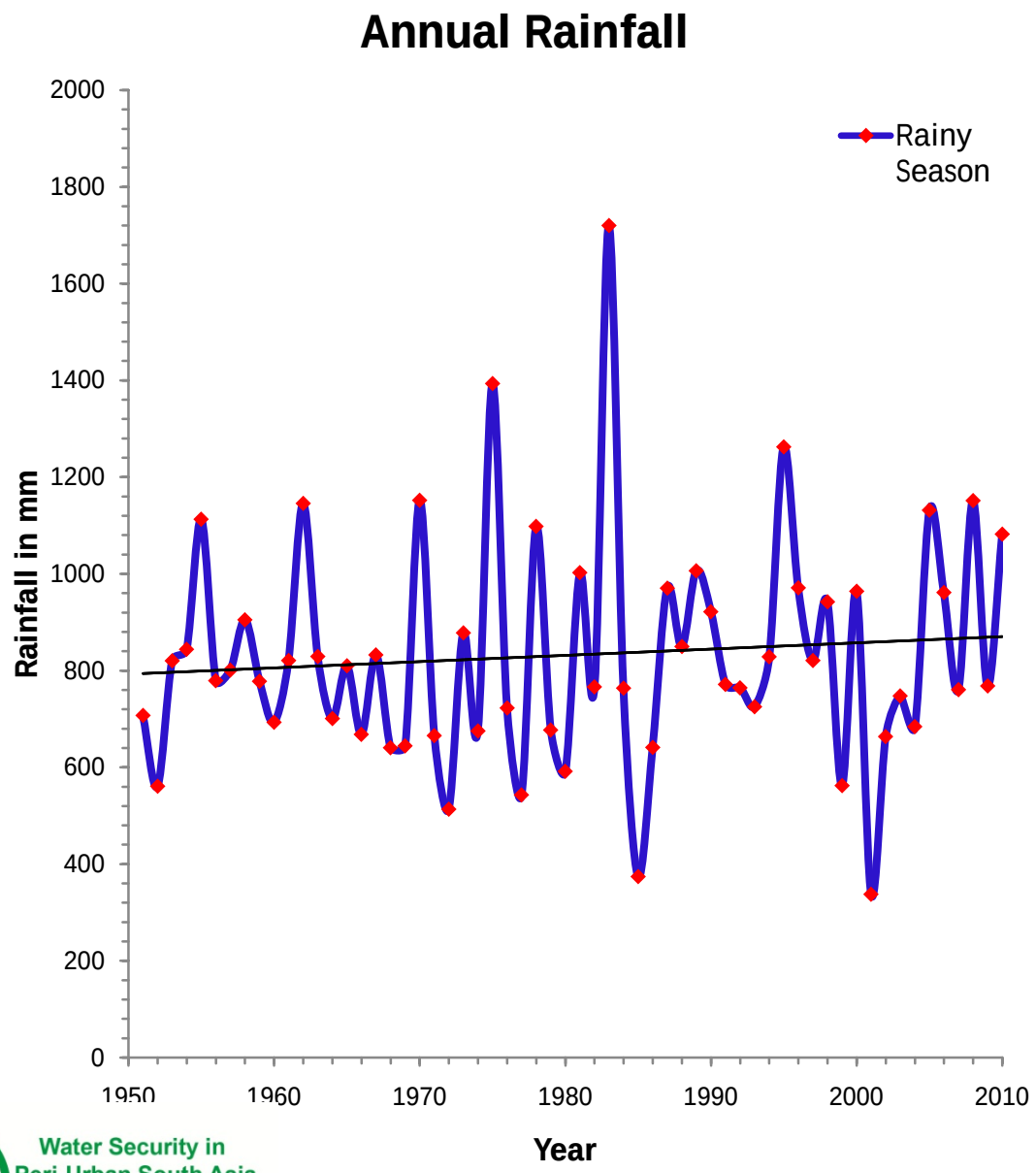

Location of Peri-urban
Research Sites in Bangladesh,
Nepal and India
North
NEPAL
Gurgaon
Kathmandu
BANGLADESH
Khulna
INDIA
Hyderabad

Evidences of Variable Climate in 4 Cities

Rainfall - Hyderabad



- Years 1985 and 2001 recorded the least rainfall of 374.5 and 337.9 mm respectively.
- These years were recorded with extreme drought conditions.
- The highest rainfall witnessed till date was in the year 1983 which was 1720.3mm.
- The latter half of 2000 decade saw a good rainfall varying from 600-1100 mm.
- The average annual rainfall in Hyderabad seemed to be around 700-800 mm.

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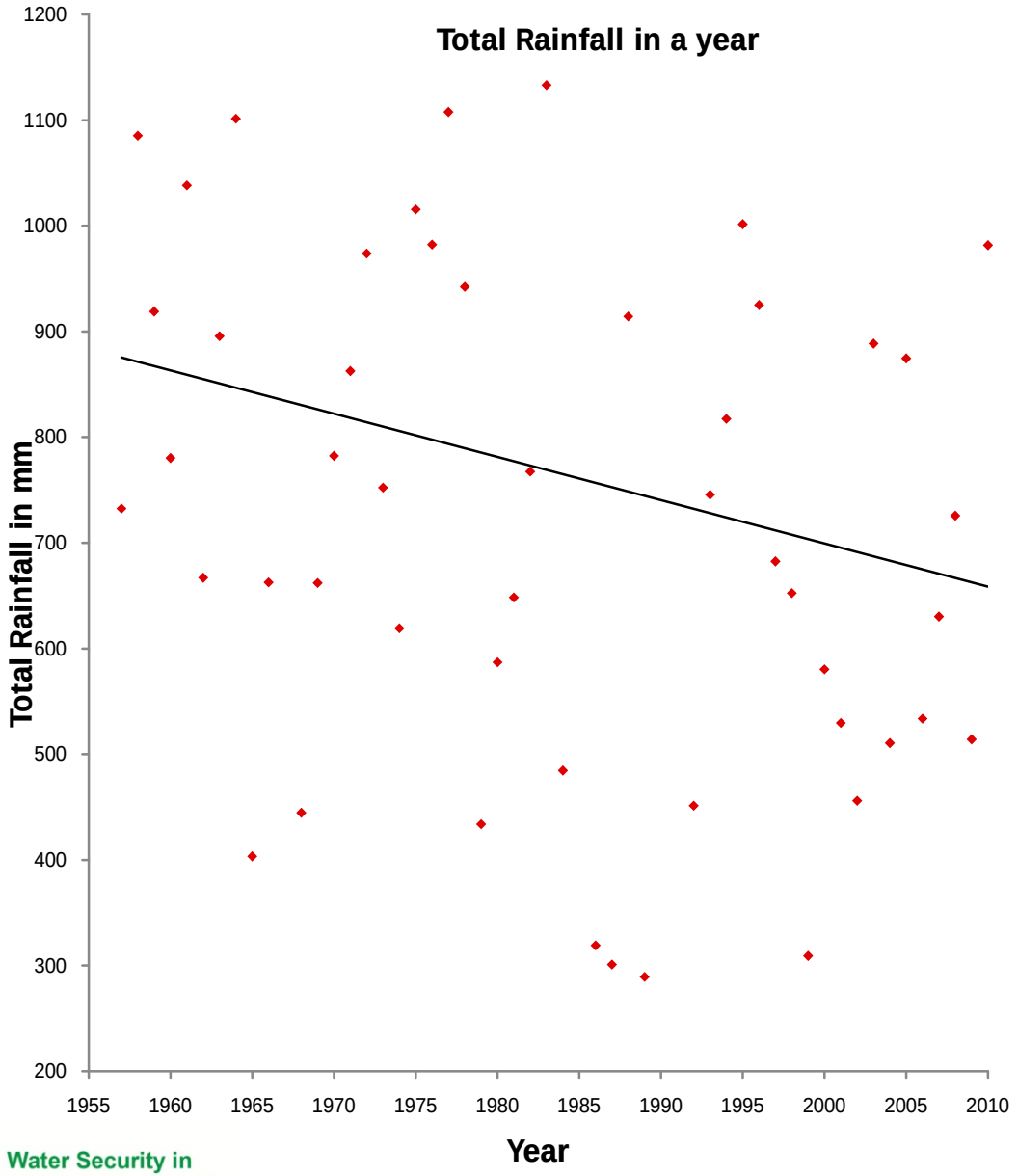
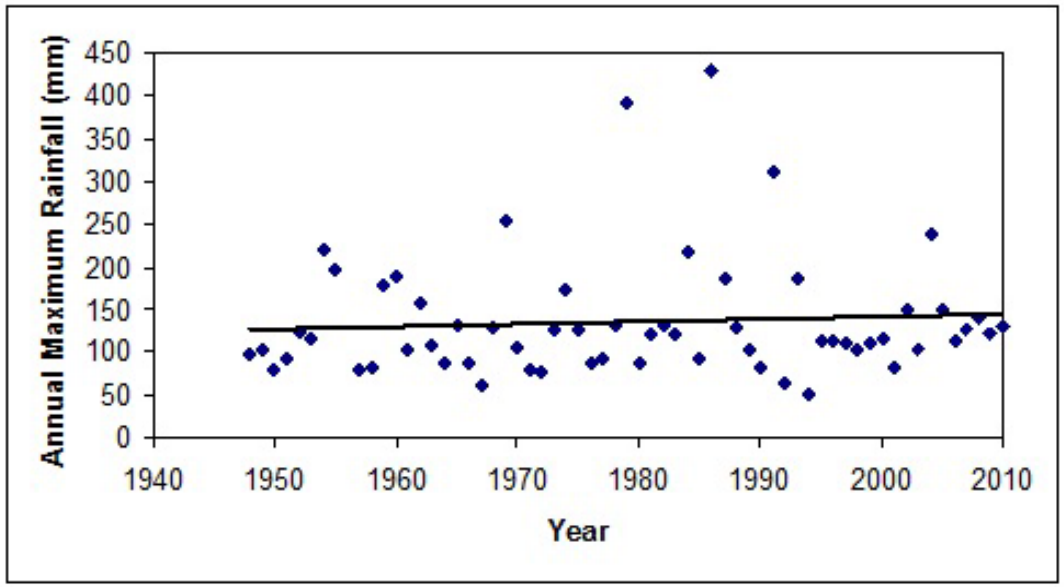
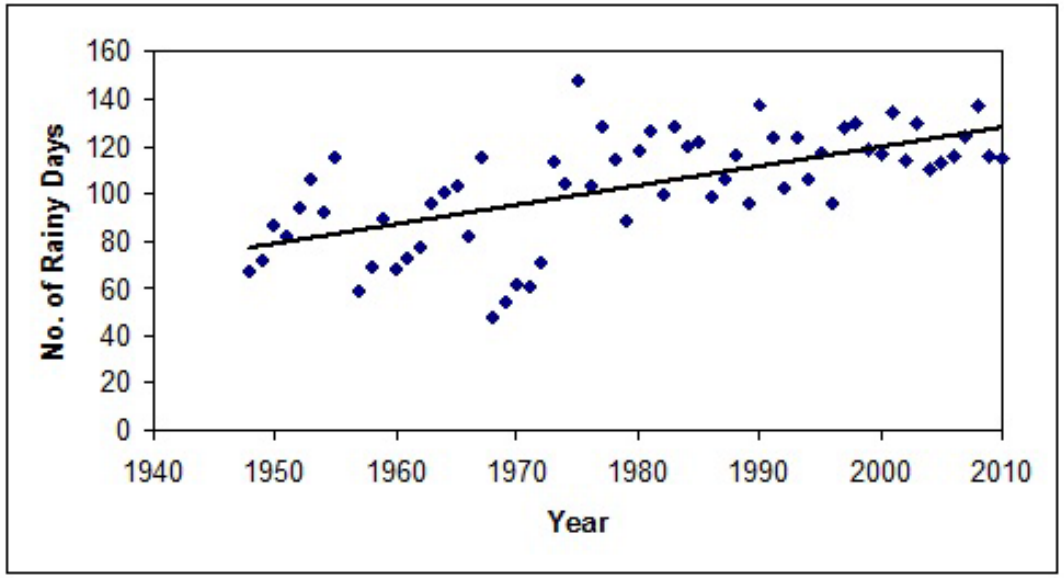
Rainfall - Gurgaon



- Agriculturists in Gurgaon complaint about the less amount of rainfall or no rainfall at all.
- The graph depicts how the rainfall is drastically reducing over the years.
- The year 1985 witnessed a highest rainfall of 1523.4 mm.
- However, the years 1986, 1987 were the drought years where the year 1989 witnessed the least rainfall of 289.4.
- From 1997 onwards, the amount of rainfall that was recorded lies below the trend like except for the years 2003, 2005, 2008 and 2010 which received average rainfall about 888.5, 874.5, 725.61 and 981.6 respectively.

Rainfall - Khulna





- The analysis of rainfall data for a period of 63 years (1948-2010) at Khulna indicates that the rainfalls have increasing trends of 8 mm, 31 mm, 9 mm and 6 mm per decade during the winter, monsoon, post-monsoon and pre-monsoon seasons, respectively.
- However, the trends in the pre- and post-monsoon seasons are not significant at 80% level of confidence.
- The annual total rainfall is found to be increasing at 53 mm a decade which is significant at 95% level of confidence.
- The number of rainy days in a year is found to be increasing at 99% level of confidence
- The numbers of rainy days during the dry (Nov-May) and wet (Jun-Oct) seasons show increasing trends.

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Rainfall - Kathmandu

Station	Non-Monsoon	R2	Monsoon	R2
Khumaltar	0.22	0.09	0.19	0.10
TIA	0.35	0.17	0.16	0.13
Godawari	0.12	0.01	0.12	0.01
Panipokhari	-0.68	0.33	-0.11	0.04
Changunarayan	-0.46	0.16	-0.31	0.18
Sankhu	-0.35	0.09	0.06	0.01
Naikap	-1.03	0.25	-2.03	0.52

- From the table, it can be seen that four out of seven stations have a decrease in number of rainy days in non-monsoon period.
- Although this is not really convincing (also with very low *R*2 values), the pattern can be recognized that the negative direction (decrease in number of rainy days) seems to be a stronger signal than the positive directions.
- For monsoon period only three out of seven stations have a decrease in number of rainy days. Again it is recognizable that the negative numbers are in general stronger than the positive numbers.

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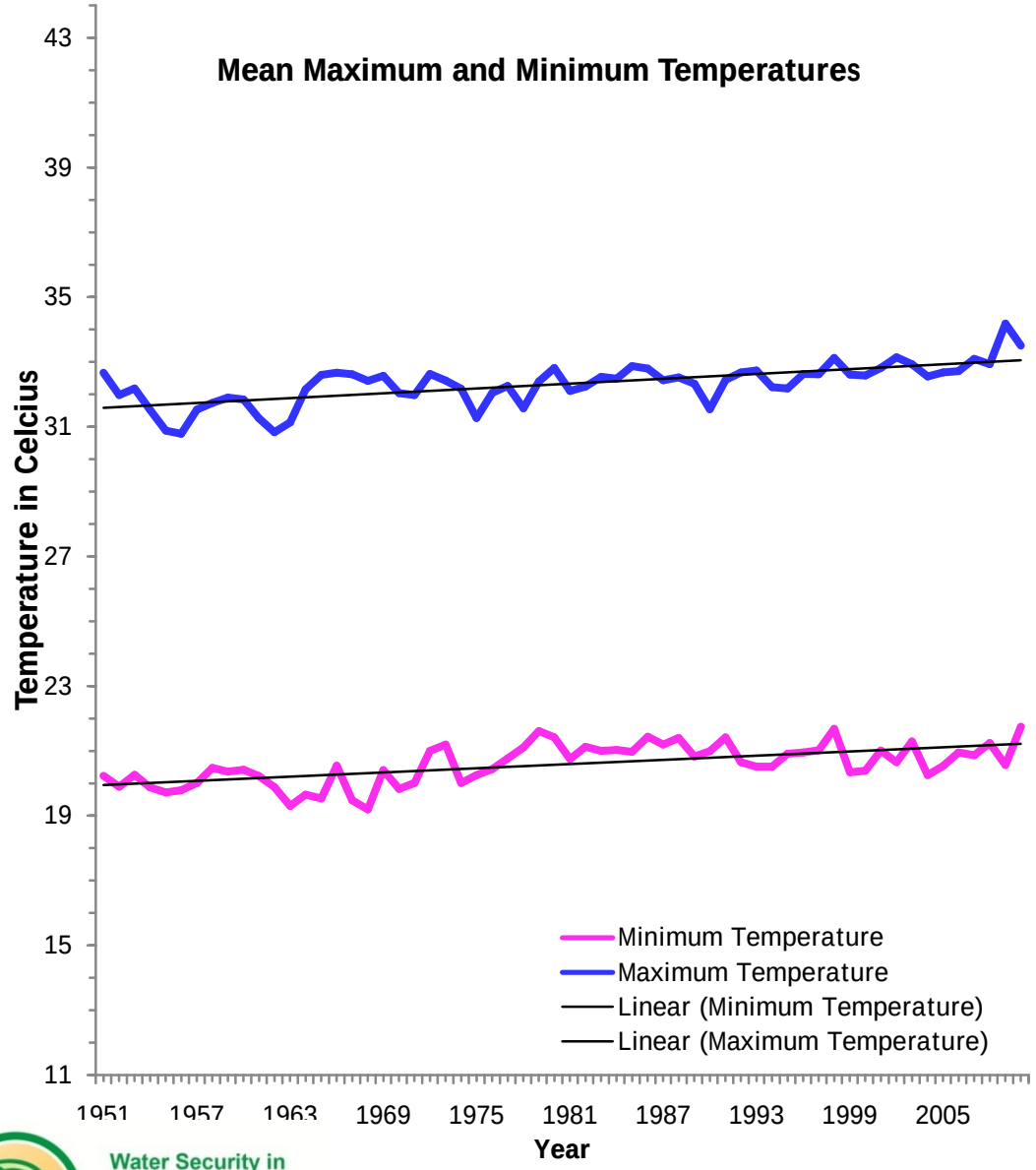
Temperature - Hyderabad



- The mean maximum temperatures have slowly fallen down after 1951, lowest bein the year 1956.
- The highest mean maximum temperature of this period was observed in the year 2009.
- The mean minimum temperature of the Hyderabad region falls in the range of 19-22°Celcius.
- The decade of 1960-70 witnessed a period of low mean minimum temperature.
- From 2009, the temperature has gradually increased, where the highest mean minimum temperature of 21.75 was recorded in the year 2010.
- Overall, the temperatures over the years have been slowly increasing as shown by the trend line s in the figure.

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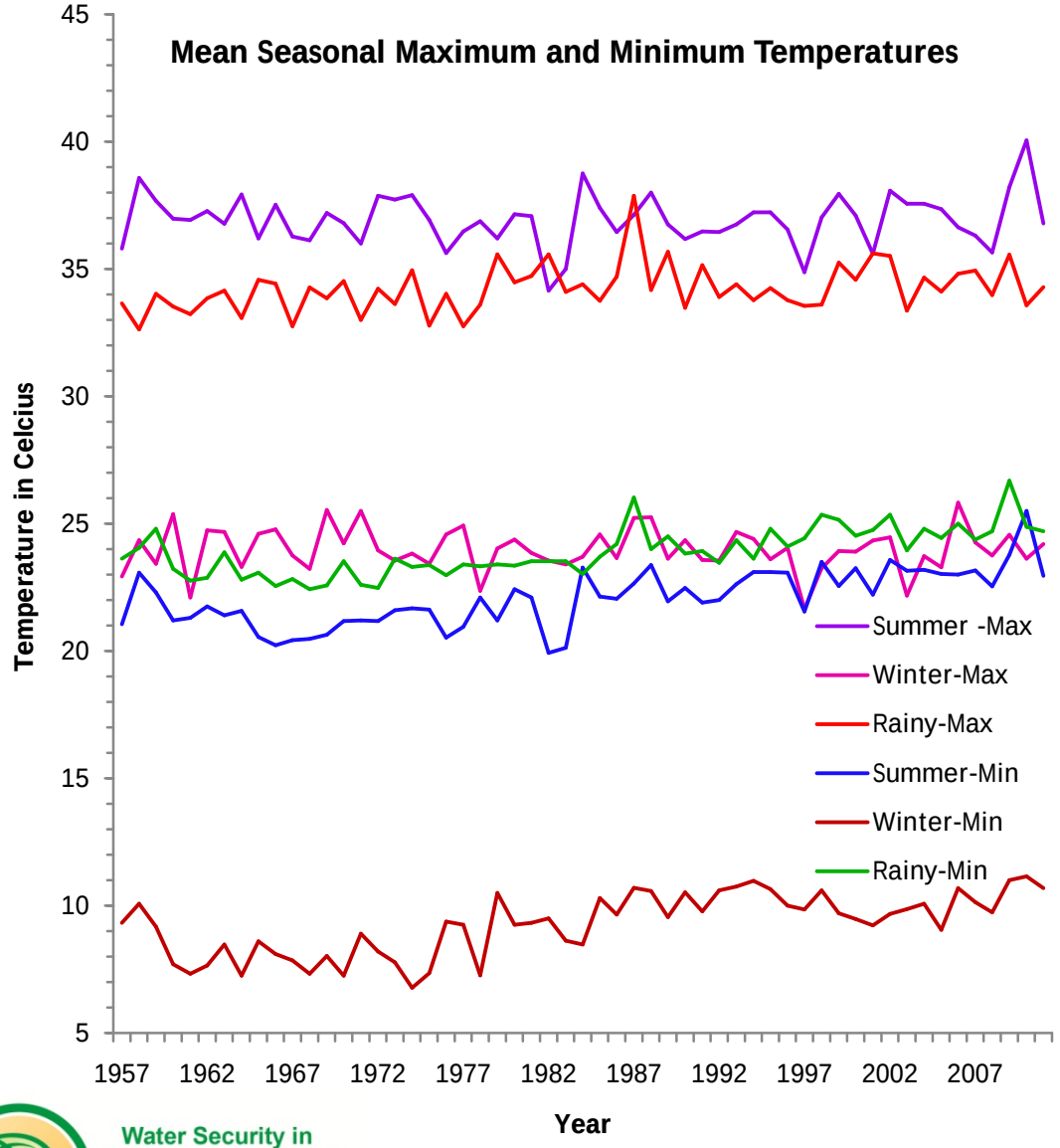
Temperature - Gurgaon



- In Gurgaon, summer season noted the highest of both maximum and minimum temperatures.
- The temperatures in the rainy season were a little less than that of summer.
- In the year 1987, the temperature in the rainy season was more than that of the summer.
- Winters in Gurgaon are extremely chilly resulting in the lowest mean temperatures with almost a temperature difference of 12.8 and 14.6 degrees to that of summer minimum and rainy minimum temperatures respectively.
- The ranges of mean maximum temperatures in the winter seasons collide with the mean minimum temperatures of both summer and rainy seasons.

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Temperature - Khulna

Season	Trend in maximum temperature for the period of		Trend in minimum temperature for the period of	
	1948-2010	1980-2010	1948-2010	1980-2010
Winter	-0.018***	0.022	-0.018***	0.047***
Pre-monsoon	0	0.034**	-0.001	0.045***
Monsoon	0.019***	0.037***	0.003	0.013*
Post-monsoon	0.021***	0.027**	0.006	0.042***

- Graphical plots of the time series indicated that the temperature at Khulna started rising faster since 1980.
- The average maximum temperatures in the pre-monsoon (March-May) and monsoon (June-September) seasons.
- The average minimum temperatures in the pre-monsoon, post-monsoon (October-November) and winter (December-February) seasons are increasing at faster rates in recent times than anticipated either from long-term observed trends or climate model projections.

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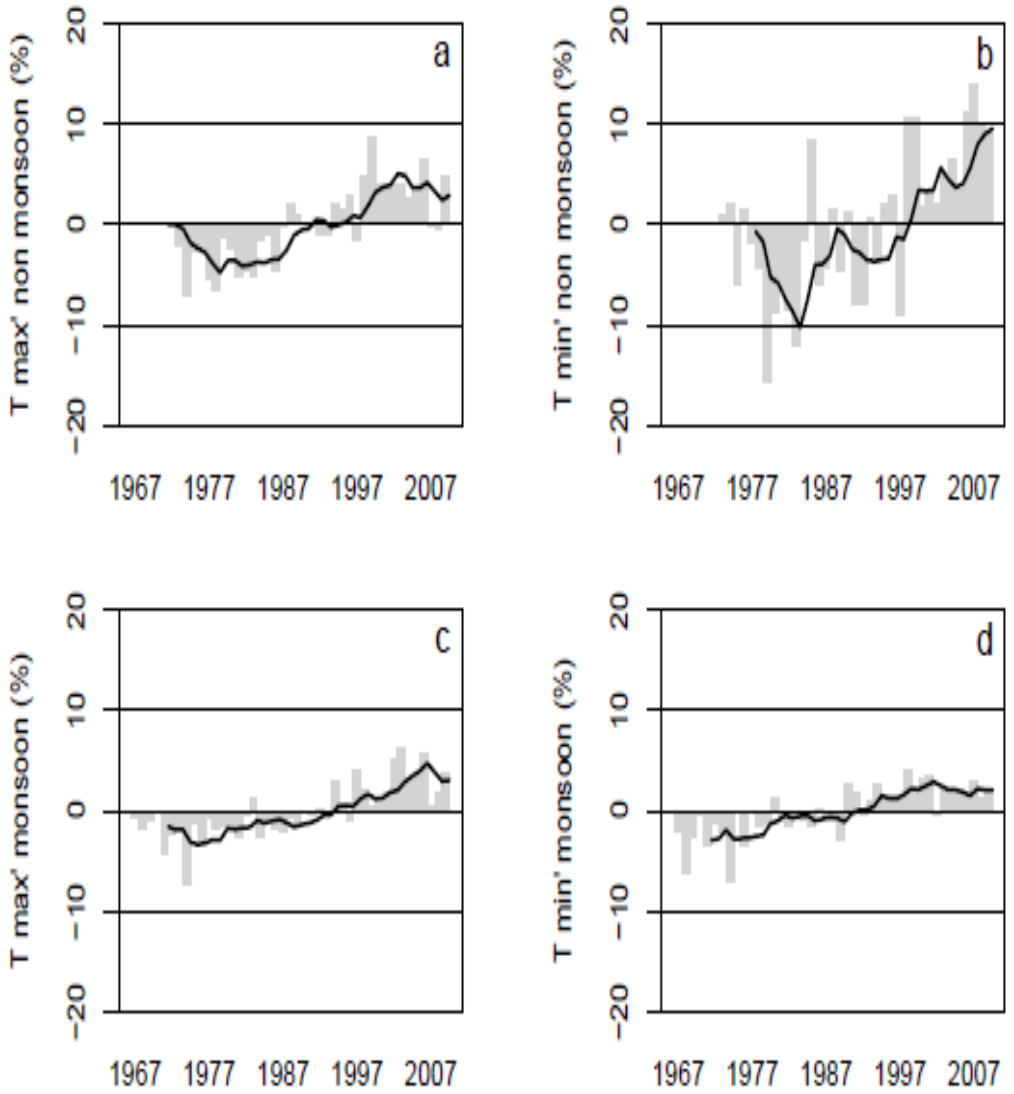
Temperature - Kathmandu



- A deviation-plot from temperature was drawn to get a first sight on the temperature in the Kathmandu valley.
- The line shows the 5 year moving average, and it is striking that the minimum as well as the maximum temperature in and outside monsoon season seem to have increased the last years.
- This signal is stronger in the non-monsoon period.
- A constant or decreasing trend in temperature for the period 1960-1976 and an increasing trend after the mid '70. is observed.
- The figure illustrates deviation from long term annual mean max. (a and c) and mean min. (b and d) temperature in non-monsoon (a and b) and monsoon (c and d) period in Khumaltar, expressed in percentage. The line gives the 5 year moving average.

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Evidences of a changing climate

Khulna	• Increase in heat index • Rise in average max temperature (0.05^0C per year) • Sea level rise and salinity ingress in fresh water bodies
Gurgaon	• Colder winder and hotter summer • Seasonal distribution of rainfall is changing • Negative trends in average max humidity • Decreasing rainfall – 3.9 mm per year
Hyderabad	• Temp increase of 1.5^0c in 60 yrs (mean max) • Mean min temp increase @0.02^0 c per year • Variability in rainfall; Rainfall is constant but rise in tem deceases water availability • Seasonal variability in temp (min &max)
Kathmandu	• Average min tem increasing @.04^0c per year • Average max tem increasing @.05^0c per year • No change in average rainfall but inter-annual variability is experienced

How are people adapting?

Technologically: Using new technologies to access, store and distribute water, for example, use of sprinkler irrigation in periurban Gurgaon

Institutionally: Developing new forms of water allocation and distribution, the evolution of new norms for water sharing, collective efforts to tap water, and access to water markets, for example, water tankers operated by private entrepreneurs in Matatirtha peri-urban village in Kathmandu

Changing in livelihood strategies: Changes in water use practices, cropping patterns or choices, settlement patterns and short and long term migration, for example, shifting from rice cultivation to vegetable and fruit cultivation in peri-urban Hyderabad

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Our learnings

Climate variability & change and urbanization intersect and create patterns of peri-urban water insecurity

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Our learnings

There is a need for disaggregating vulnerabilities (Gender, class\caste Vs access to water)

- Gender, class\caste disaggregated data shows poorest women are hard hit
- No disaggregated data available for large scale analysis
- Lack of data means lack of evidence of changing social relations

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Changing gender relations

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Our learnings

Climate science and local perception should have a meeting point

- Climate data at the aggregated level
- Extensive variability in micro climate – local level data is needed

- Scientific analysis is rarely available at local level
- Farmers are relying on their own observations and subjective interpretations

- Need for bridging the local perception and climate science data analysis
- Local action must be part of larger resilience strategies based on analytical foundations

Our learnings

Stakeholders' engagement is critical for adaptation and resilience

People are coping and adapting independently

- Communities are aware of the trade offs but the concerns are not reflected in planning process

Local preferences to be part of planning

- existing management approaches do not adequately incorporate stakeholders preferences

Bringing authorities and communities together

- This project shows that the involvement of communities and the immediate line departments would yield benefit in getting the planning right

Way Forwards

Break away from the dichotomy between rural and urban water governance	Expansion of cities and urban spaces should factor careful water resource plans	Stakeholders and civic agencies require sensitization to issues of peri-urban water insecurity
Planning and governance must consider the inter-relationship between rural and urban water flows	This would prevent periurban populations from being marginalised and adversely affected by urbanisaton	Policy makers must engage in a constructive dialogue with affected communities

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Thanks

For more information about the project

Please visit

www.saciwaters.org/periurban

Contact Anjal Prakash

anjal@saciwaters.org