



Water Resources & Adaptation to Climate Change with a Focus on the Ganges

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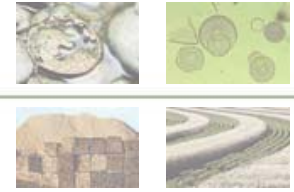
Regional Technical Workshop on Application of Modeling Tools for
Climate Change Impact and Vulnerability Assessment. MRC/CSIRO.
8-9 September 2009, Bangkok, Thailand



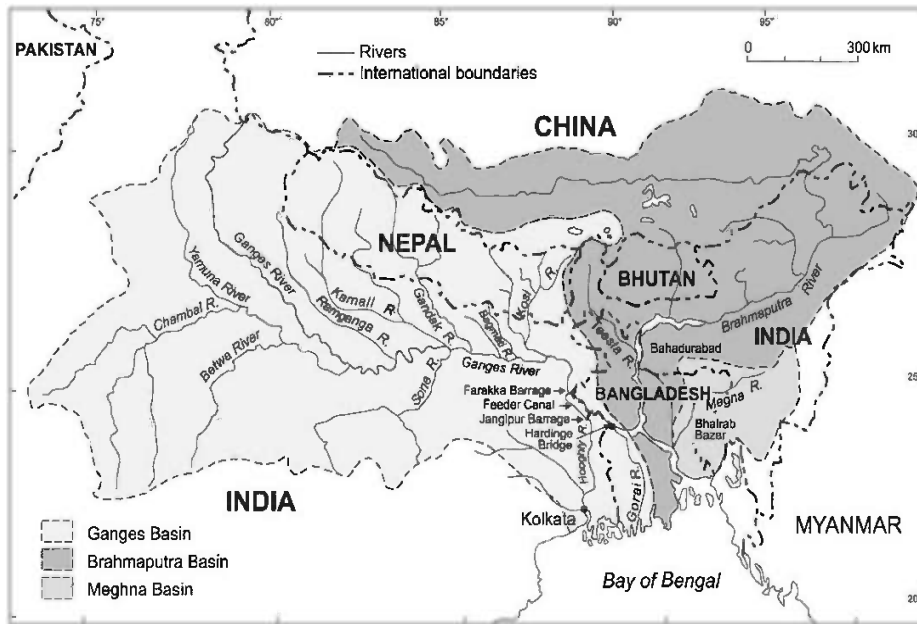


CONTEXT

- Water and how it is managed, presents one of the more significant opportunities to enhance resilience and adapt to present and future climate variability
- Prudent water management can moderate the effect of hydrological extremes, provide the basic platform for livelihoods and economic development, reduce the fluctuations in production, and sustain ecosystems.
- However, most decisions related to water resources management are political in nature, many cases beyond the water sector itself, and taken with less than perfect information
- Ensuring good decisions is further complicated as current decision support and planning paradigms rest heavily on the assumption of climatic and hydrologic stationarity.



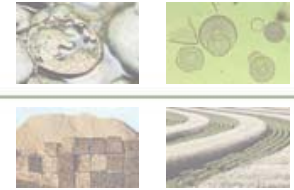
CASE OF THE GANGES



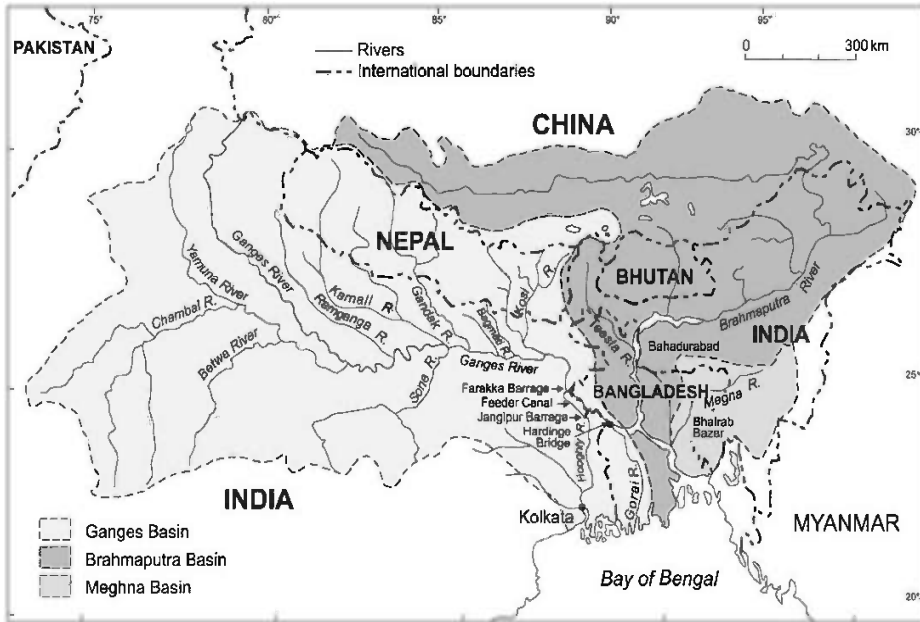
Source: Mirza (2002)

Water resources and utilization are changing due to:

- Population growth
- Economic development
- Governance and management practices (including beyond the water sector), and
- Climate change



CLIMATE CHANGE THREATS



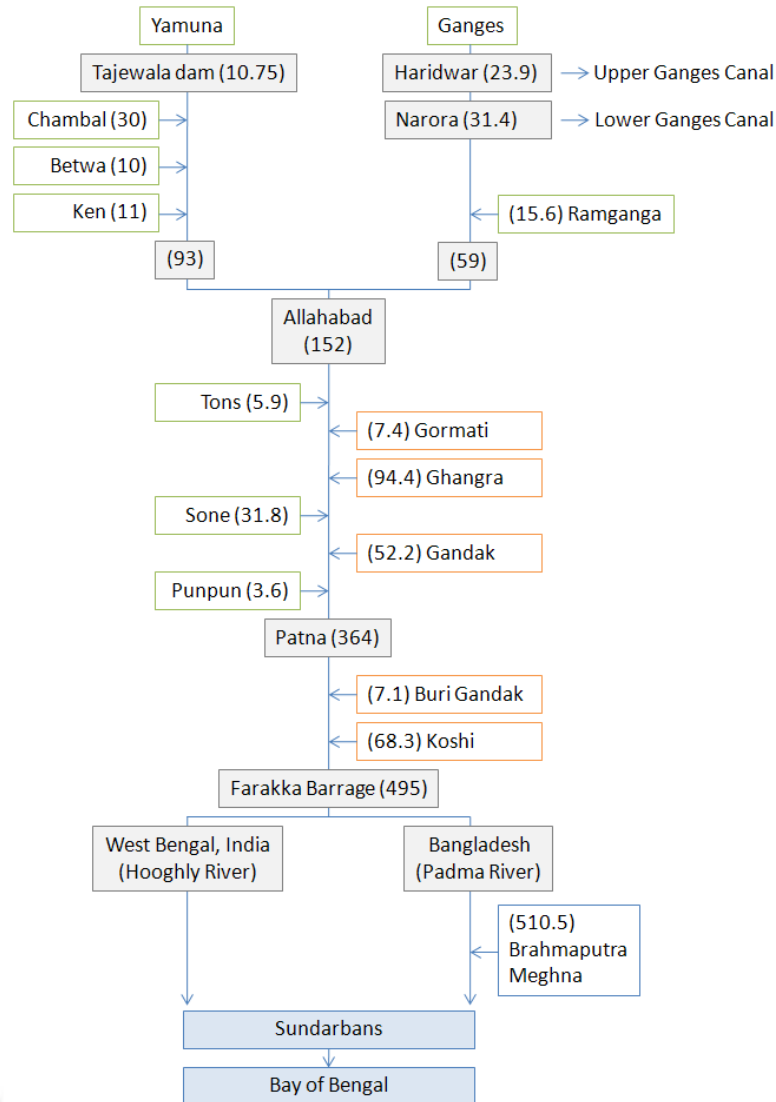
- Glacier/Snowpack melt characteristics
 - Varies by sub-basin
 - Greater significance to the west
- GLOFs
- Yet Ganges is a monsoon driven river with 500 million inhabitants
 - Water & Food security
 - Surface – Groundwater – Rainfed - Interconnections
 - Water & Flooding
- Cyclones





Climate risks	India	Nepal	Bangladesh
Temperature rise	High	Very high	High
Glacier retreat	High	High	---
Frequent floods	High	High	Very high
Frequent droughts	High	High in some areas	High in some areas
Sea-level rise	Modest	---	Very high





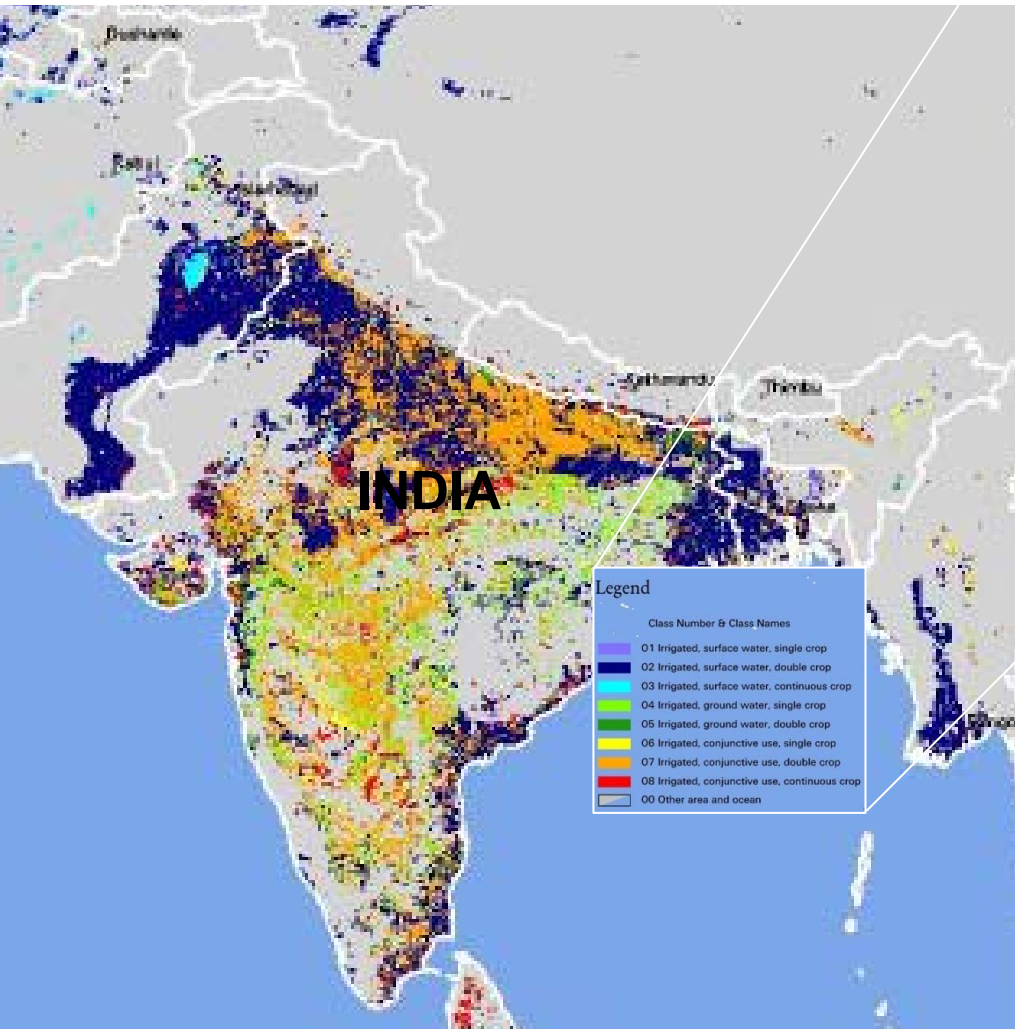


- Intersection of water and climate change on key sectors – experience, impacts and opportunities:
 - **Agriculture/Food Security**
 - **Energy**
 - Health
 - Ecosystems











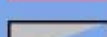


IRRIGATED AREAS OF SOUTH ASIA



Legend

Class Number & Class Names

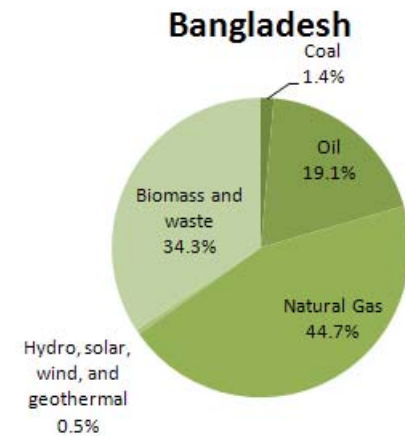
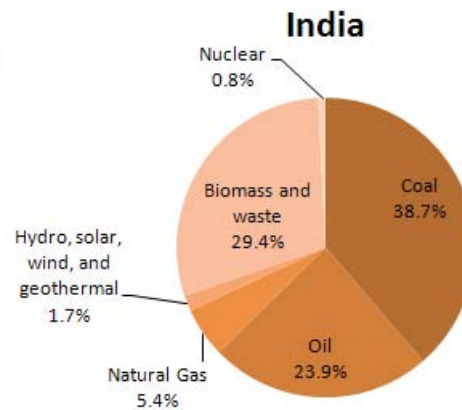
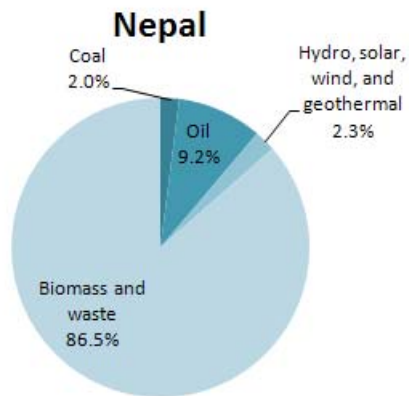
-  01 Irrigated, surface water, single crop
-  02 Irrigated, surface water, double crop
-  03 Irrigated, surface water, continuous crop
-  04 Irrigated, ground water, single crop
-  05 Irrigated, ground water, double crop
-  06 Irrigated, conjunctive use, single crop
-  07 Irrigated, conjunctive use, double crop
-  08 Irrigated, conjunctive use, continuous crop
-  00 Other area and ocean

Thenkabail, et al (2005)





Per capita energy consumption in kilograms of oil equivalent (kgoe)	Ganges basin countries			Global
	Nepal	India	Bangladesh	
1990	304	377	123	1,668
2000	334	452	145	1,657
2005	338	491	171	1,778





- Existing and emerging institutions, relevance to adaption & current commitments:
 - UNFCCC funding
 - South Asia Water Initiative (SAWI)
 - Ganga River Basin Authority (GRBA) – within India
 - ICIMOD as a regional platform
 - Country specific NAPAs and other adaptation plans
 - As with elsewhere, these are modest in scope
 - Bilateral agencies (eg. DfID, DANIDA)





- Broad strategies for enhancing adaptation

- Flexible institutions
 - Based on adaptable planning and decision making systems
 - Local to transboundary scale
 - Groundwater markets in West Bengal
 - Water users groups and small storage facilities
 - Transboundary - lessons from the Indus Treaty
- Conjunctively manage water resources (surface, ground and precipitation)
- Strategic use of storage continuum (large scale surface – in-system reservoirs - groundwater – soil-water)





- Broad strategies for enhancing adaptation (cont)

- Increase yield/water productivity
- Improve water quality
 - Domestic wastewater is a major issue
 - Industrial pollution also, and severely complicates the challenge
 - Agriculture
- Recognize and protect ecosystem services and environmental flows
- Support risk management
 - Bangladesh – fatalities have been declining, but economic loss continues to increase (CEGIS)





- Barriers to implementation
 - Data & information
 - Capacity: *Technical, Financial & Human*
 - Physical
 - Socio-Political
 - Institutional





CLOSING THOUGHTS

- Water resources are effected by a range of drivers beyond the water sector, and adaptation is entwined with broader development processes.
- Models and decision frameworks increasingly need to capture relationships between livelihoods and water management under changing conditions and circumstances.





WORKING PAPER

Water, Climate Change, and Adaptation

Focus on the Ganges River Basin

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NI WP 09-03

Explores the intersection between water resources management and climate adaptation in this critical basin

