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Groundwater regulation in delta environments – challenges and future projections in Bangladesh

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ESPA Deltas: Project Aims

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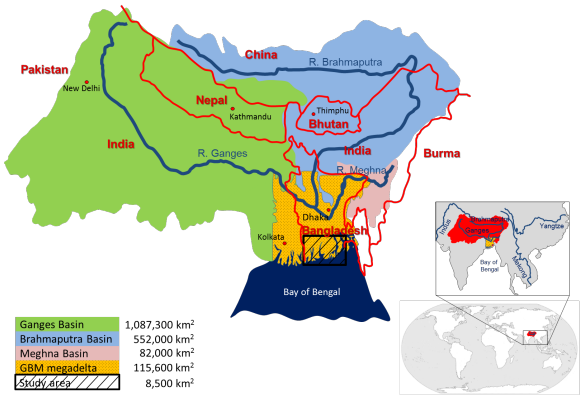

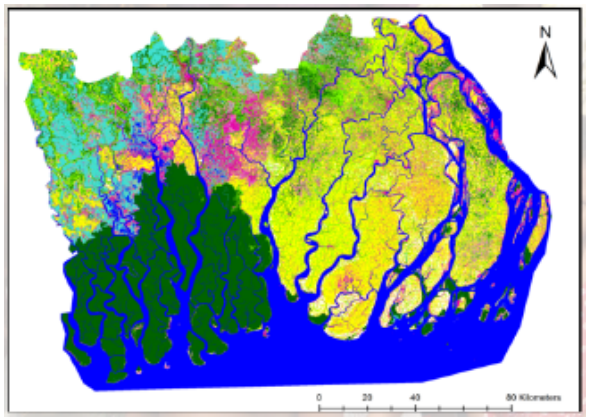

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In Coastal Bangladesh

- To understand the present relationship between ecosystem services and human well-being and health.
- To project how these ecosystem services might evolve over the coming years and decades (up to 50 -100 years)
- To analyse how policy can influence these outcomes and promote ecosystem services and human well-being and health.
- To select robust policies that are effective across the range of uncertainty.
- Using participatory approaches.

Problems affecting ecosystem services and livelihoods

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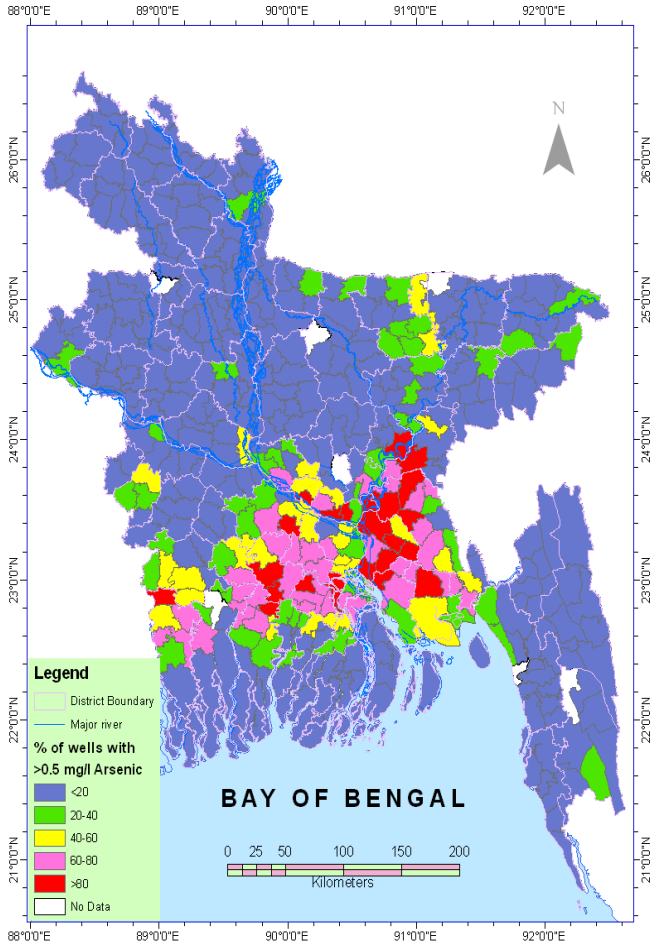
- **Naturally-occurring arsenic contamination of aquifers**
  - Linked to deltas more generally (young sediment is prone to contamination)
  - Pumping comes from deeper aquifers, rather than shallower aquifers where arsenic is present, but may cause contamination of deeper aquifers over time
  - Potential for large scale groundwater pumping for irrigation to increase arsenic build-up



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Problems affecting ecosystem services and livelihoods

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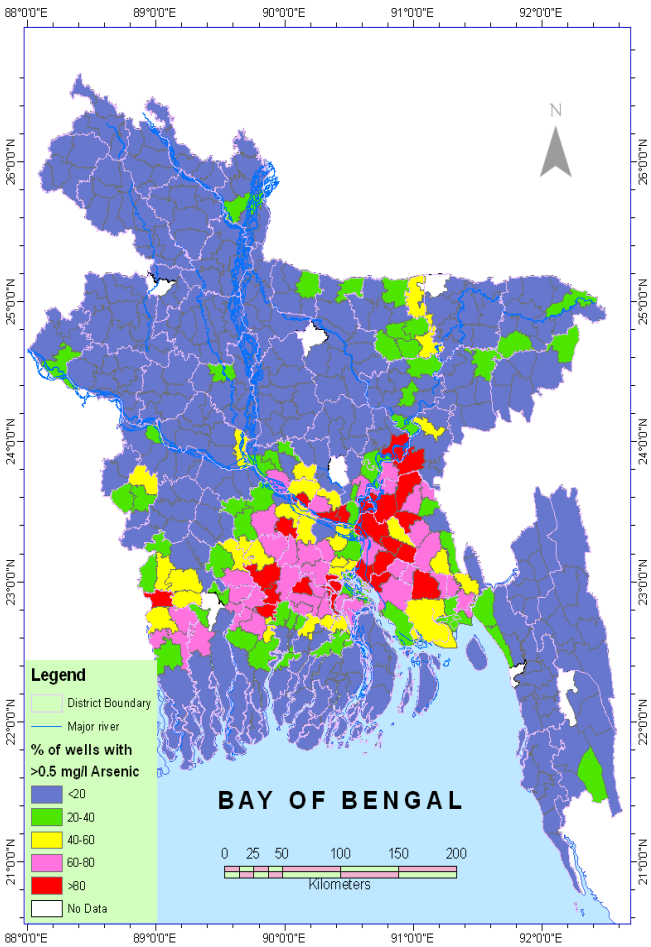
- **Naturally-occurring arsenic contamination of aquifers**
  - 97% of population rely on groundwater for drinking water
  - Health (and social) impacts on those drinking contaminated water (e.g. arsenicosis, mental health impacts on children) – Economic cost est. $23 bn/a
  - Affects both crop (e.g. rice) yield, and present in food chain where irrigation by groundwater
  - Areas with lower levels of recharge more likely to exhibit higher concentrations of arsenic
  - Community-based contaminant removal most effective
  - Alternatively, as arsenic incidence is highly localised, alternative sources may be used (Arsenic Policy) – preference for surface waters



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Problems affecting ecosystem services and livelihoods

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Salinisation

- Arises as result of number of factors:
  - Low flows, especially during dry season
  - Sea level rise
  - Ineffectively regulated groundwater extraction
  - Water-logging following flooding, due to poor drainage (includes poor infrastructure maintenance)
  - Heavily influenced precipitation patterns – projections indicate greater intensity of events, with less recharge
- Major impact on agriculture and land use potential
- Irrigation practices and land use (especially shrimp production) also relevant – difficult to balance short term livelihood needs against longer term sustainability of ecosystem services

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Summary might be:

- Better management of groundwater irrigation imperative:
  - Avoid potential problem of arsenic contamination in deeper aquifers
  - Avoid exacerbating equiibrium between SLR and saltwater intrusion (i.e. moving it north)
  - Acknowledge projections suggesting more limited aquifer recharge in the future (i.e. because of changes in precipitation, and lower f/w inflows)
  - Might this also alleviate problems of water supply in urban areas caused by rural-urban migration – i.e. increasing urbanisation, especially in Dhaka
- Mitigation of impacts of arsenic addressed as public health issue (Arsenic Policy 2004), but preference for surface water alternatives raises issues for S/W water quality standards

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Groundwater – legal frameworks: Transboundary

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- Treaty on Sharing of the Ganges at Farakka (Bangladesh / India, 1996)
  - No provisions as to water quality
  - Reflects flows 1949-1988. Impact of non-stationarity unclear at present
- Joint **Rivers** Commission (Bangladesh / India, established 1972)
- Teesta Agreement not yet signed
- No formal agreement on shared groundwater
- None of the basin states have ratified the UN Watercourses Convention

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Upstream uncertainties potentially affecting flow in the GBM delta:

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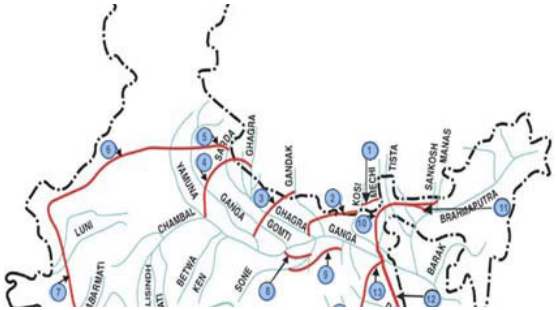


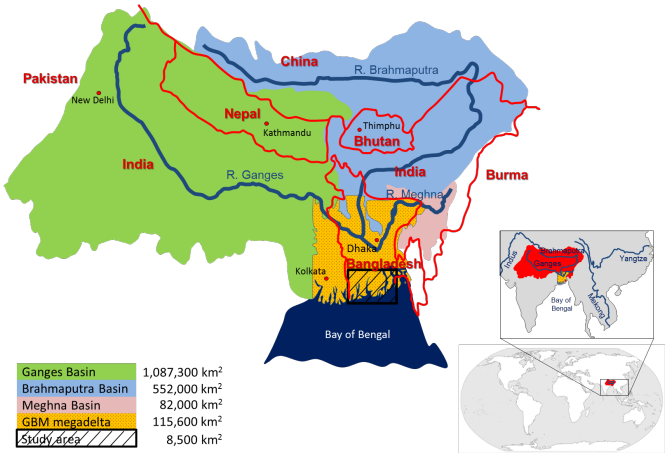
Inter-linking Rivers Project (Himalayan component)

Agreement on the Teesta River: imminent?

High level of uncertainty re. future changes in temperature (conservative projection: +2°C by 2050) and precipitation patterns

Possible diversion of Brahmaputra by China for north-south Diversion projects?

World Bank-linked Development of NW-1, upstream of Farakka?



Accelerating hydropower Development on Ganges And Brahmaputra rivers In both India and China

Renegotiation of the Farakka Treaty in 2026

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Renewed focus on Ganges clean-up

Challenges for adaptation in Bangladesh – domestic factors

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- Levels of coordination re. hydrometeorological planning and data sharing with upstream states are inadequate
  - Ability to adapt to **upstream adaptation** is therefore limited
- Initial National Adaptation Plan has now expired
  - Focus on salinity with respect to groundwater
  - preparation of new adaptation plan has just started, led by UNDP
- Relevant governance framework for water resource and land management is generally:
  - outdated
  - rigid but lack of detail increases scope for arbitrary decisions;
  - enforcement penetration is inadequate (e.g. with respect to informal systems); and
  - Is not capable of supporting policy

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Policy / Law Timeline in Bangladesh

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Chart suggests there is relatively little implementation of policy through law, for example, but that doesn't mean there is none through e.g. infrastructure; investment; economic tools etc.

Policy	Year	Legislation
National Social Protection Strategy (3rd draft)	2014	
	2013	Water Act
	2012	
	2011	
Sixth Five Year Plan Plan for Disaster Management National Industrial Policy Perspective Plan Child Labour Elimination Policy	2010	Standing Orders on Disaster
National Adaptation Plan of Action National Tiger Action Plan	2009	Right to Information Act
	2008	
	2007	
Coastal Development Strategy National Fisheries Strategy National Food Policy	2006	
Fifth Five Year Plan Coastal Zone Policy	2005	
	2004	
	2003	
Population Policy	2002	
Rural Development Policy	2001	
	2000	Environment Court Act Water Development Board Act
National Water Policy	1999	
National Fisheries Policy	1998	
	1997	Environment Conservation Rules
	1996	Ganges Water Sharing Treaty
	1995	Environment Conservation Act Protection and Conservation of Fisheries (Amendment) Act
National Forest Policy	1994	

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Challenges for adaptation in Bangladesh – domestic factors

- Planned mega-irrigation projects and barrages in Bangaldesh (i.e. infrastructural response to reducing flow) may not be implemented due to lack of resources
- Getting legislation through legislature is very time consuming, and binary political system does not help
- Capacity of legal, institutional and policy framework to facilitate adaptation is low in terms of adaptive governance principles:
  - Iterativity
  - Flexibility
  - Connectivity
  - Subsidiarity

Bangladesh legal framework for Groundwater

- Legislation
  - Groundwater Management Ordinance 1985
    - Focused entirely on agriculture
    - Criteria against which applications for tubewell licences are measured are vague, and include nothing on sustainability, aquifer capacity, or environmental impacts.
    - Grandfathering of existing uses

Bangladesh legal framework for Groundwater

- Legislation
  - Water Act 2013 (English language version)
    - Requires clearance certificate for projects
    - Lack of clarity re. G/W - 'lowest safe yield level' can be set (when?) – "the amount of abstraction of water that keeps the aquifer safe and protective" (s.19)
    - Users then permitted to sink wells, subject to LSYL and other rules – including GMO above?
    - Provisions re.prohibition of absolute exhaustion of water sources only applies to S/W
    - Water Stress Areas can be set up (including for aquifers), though criteria absent
      - Priority uses for WSAs include agriculture and aquaculture, before 'balancing ecosystems' and wildlife
      - Appears easy to undermine – get-out clauses…

Observations and conclusions

- Legal framework very weak for groundwater, despite policy committing to protecting shallow aquifers especially – question re. has Water Act done what 1999 Policy required re. scarcity zones?
- Substituting surface water sources for groundwater – for irrigation and for arsenic mitigation – may be problematic due to regulatory framework, but could it be a benefit of greater upstream regulation (if this meant more water during low flow periods?)
- Water Act especially disappointing
- Clear need for effective rehabilitation and protection of aquifers (and avowed policy aim)
- Poverty and government economic priorities likely to compromise this objective, despite rapid growth over past decade or so

Observations and conclusions

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- Characteristics needed for licensing in face of changing climatic and demographic conditions absent
- Monitoring and enforcement capacity inadequate (in 2010, the court backlog was 1.8 million cases)
- Relationship with India not actively helping – current coordination efforts are track 2, though Modi-Hasina relationship may be better than expected – e.g. Land Borders Act. Too early to tell – much-delayed Teesta agreement may be first test for water
- Policy / adaptation focus on responding to salinity (e.g. through surface water irrigation projects and salt-tolerant rice varities) rather than mitigating causes (increased coordination with India and joint planning) gives indication of how Bangladesh feels about its relationship with India and scope for change

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References and Acknowledgements

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