

Managing the Interactions between Climate Change and Groundwater: The Indian Experience

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Fact File

- Different uses of water
 - Drinking, irrigation, industrial use
- Traditional main source – surface water (SW)
- Increase in use of groundwater (GW)
 - 40% of total available water resources
 - 30 million+ GW users in India
 - Irrigation (55%); rural water supply (85%); urban and industrial water (50%)
- Reasons
 - Local availability
 - Technological innovations
 - Property rights' regime
 - Law of capture
 - No incentive to cooperate
 - Reduction in supply of SW
 - Separate regulation of SW and GW; much lesser regulation of GW
 - Not readily visible/measurable

Growing concern for GW availability

- GW hotspots
 - Punjab, Rajasthan, Maharashtra, Karnataka, Gujarat, Andhra Pradesh and Tamil Nadu
- Why do we need GW regulation?
 - 5842 assessment units (in 2011)
 - 802 (over-exploited)
 - 169 (critical)
 - 523 (semi-critical)
 - 4277 (safe)
 - 71 (saline)
- Reasons
 - Overdraft/mining/subsidence
 - Waterlogging
 - Seawater intrusion
 - GW pollution

Impacts of CC on Water Resources

- Observed changes – variability
 - ↑ surface air temperature
 - Rainfall – regional variations
 - ↑ frequency & magnitude of extreme weather events
 - ↑ sea level rise
- ↑ water demand; ↓ water supply

Impacts of CC on GW

CC Impact	Resulting Impact on GW
Changes in precipitation & evapo-transpiration	GW recharge
Rise in sea level	Increased saline intrusion into coastal and island aquifers
Increase in frequency and severity of flood and drought events	GW quality in alluvial aquifers
Increase in rainfall intensity	Increased flood events; higher surface runoff & soil erosion and possibly reduced recharge

AR5-IPCC on GW

- 2007 – start of investigation of relation b/w GW and CC
- ↑ future rates of SLR
 - ↑ coastal flooding, erosion, and saltwater intrusion into GW
- ‘GW sources, which are affordable means of high-quality water supply in cities of developing countries, are threatened due to over-withdrawals...The drop in GW levels often results in land subsidence, which can enhance hazard exposure due to coastal inundation and sea-level rise, especially in settlements near the coast, and deterioration of GW quality.’

GW in CC Law & Policy

- No comprehensive law at Union or State level
- National Action Plan on Climate Change (2008)
 - Existing & proposed actions
 - Co-benefits approach: promote development goals + respond to CC
 - Large uncertainties concerning spatial & temporal magnitude of CC impacts
 - Rapid and sustained development can generate required financial, technological and human resources
 - Eight Missions including
 - National Water Mission (2011)
 - National Mission on Sustainable Agriculture (2010)
- State Action Plans on Climate Change

National Water Mission

- Focused attention to vulnerable areas including over-exploited areas
 - Promotion of traditional water conservation system
 - Implement programme for repair, renovation and restoration of water bodies
 - Increase capacity of minor tanks
 - Rehabilitation of water bodies
 - Physical sustainability of GW resources
 - Enact & enforce GW law
 - Implementation of water conservation programme
 - RWH & GW recharge
 - Community participation in monitoring, regulation & management
 - Promotion of panchayat/district-level model for GW regulation
 - Intensive GW recharge programme
 - RWH & artificial recharge
 - Dugwells

National Water Mission (contd.)

- Comprehensive water database in public domain and assessment of impact on water resources
- Promotion of citizen and state actions for water conservation, augmentation & preservation
 - Empower & involve local institutions (PRIs, ULBs, WUAs) in water resources management
 - Sensitize elected representatives of over-exploited areas and orient investment under MNREGP towards water conservation
- Increase water use efficiency by 20%

CC/Environment in Water Laws

- No comprehensive water law
- Draft National Water Framework Bill (2013)
 - References to CC
 - Project planning and management
 - Coordination and policy support mechanism
- Water-related laws
 - Irrigation laws & laws governing local authorities (responsible for DW supply)
 - References to environmental protection
- GW laws
 - Model Bill to Regulate and Control the Development and Management of GW (2005)
 - Emphasis on development and management
 - Led to a series of state-level GW laws
 - Draft Model Bill for the Conservation, Protection and Regulation of GW (2011)
 - No explicit reference to CC
 - Emphasis on conservation, protection and regulation
 - Specific references to environmental protection

CC in Water Policies: National Level

- National Water Policy (2002)
 - Regulate GW over-exploitation
 - recharge potential + social equity
 - Avoid over-exploitation of GW, especially near coast to prevent ingress of seawater into sweet water aquifers
 - Monitor GW quality
 - Develop GW potential of drought-prone areas
 - No explicit reference to CC
- National Water Policy (2012)
 - Specific section on 'Adaptation to Climate Change'

GW in Environment-related Laws & Policies

- Environmental pollution laws
 - Water (Prevention & Control of Pollution) Act, 1974
 - Environment (Protection) Act, 1986
 - Coastal Regulation Zone Notification, 2011
- National Environment Policy (2006)
 - Sections on GW and on CC but linkages are not discussed

GW Recharge: Urban Areas

- Municipality Building Rules/Bye-laws
 - Traditional water conservation practice: RWH
 - Mandatory for buildings in some states and cities
 - Based on age (new or old building), size of footprint area, plot area, number of storeys, and private, government, commercial or residential use
- Court decisions – prohibitions
 - GW use by construction industry
 - Concretization of public parks that limits GW recharge
 - Plantation of eucalyptus trees (high GW consumption)
 - River bed mining
- Comprehensive strategy for GW use regulation by large industrial and commercial establishments (NEP)

GW Recharge: Rural Areas

- National policies
 - Design techniques for road surfaces and infrastructure to enhance GW recharge (NEP)
 - Undertake artificial recharge projects (NWP)
- Artificial GW recharge schemes
 - Scheme on Artificial Recharge to GW through Dugwells in Hard Rock Areas (2007-2010)
 - Master Plan for Artificial Recharge to GW in India (2013)
 - RWH, percolation tank, check dams, recharge shafts etc.
- Minor irrigation schemes
 - Mahatma Gandhi National Rural Employment Guarantee Act, 2005 (MGNREGA)
 - Minimum 100 days of guaranteed wage employment to every rural household for unskilled manual work
 - Works include water conservation and water harvesting, check dams, percolation tanks, renovation of traditional water bodies including desilting of tanks
 - Guidelines for the Continuation of Scheme on Repair, Renovation and Restoration (RRR) of Water Bodies in XIIth Plan (2013)
 - Increase tank storage capacity – by comprehensive improvement and restoration of water bodies
- Recognition of importance of community-led approaches

Prevention of GW Over-extraction

- Prevalence of command-and-control approach
- Guidelines/Criteria for Evaluation of Proposals/Requests for GW Abstraction (CGWB, 2012)
 - Notified areas
 - Permit GW abstraction through any energized means only for DW purposes
 - Non-notified areas
 - Permit GW withdrawal by new or under expansion industries/ infrastructure projects
- Flagrant violations

Practices to Increase Coping Capacity

- Policy framework
 - Promote efficient water use techniques (sprinkler/drip irrigation) & support feasible and remunerative alternative crops
 - CC adaptation through adoption of compatible cropping patterns
 - Local-level regulatory mechanisms – orders of village panchayats
- [Punjab/Haryana] Preservation of Sub-Soil Water Act, 2009
 - GW preservation by prohibiting sowing/transplantation of paddy crop before prescribed time
 - Punitive provisions
 - Destruction of paddy sowed/transplanted before prescribed period
 - Pecuniary penalty per hectare of land in violation of law

Impacts of GW on CC

- Overconsumption of diesel & coal-based electricity
 - GHG emissions
- Regulation of use of electricity for GW extraction
 - Pricing
 - Separate electric feeders for pumping GW for agricultural use
- Reduce subsidies
 - Farmers do not pay for electricity
 - If they pay, on flat tariff basis
 - Exception – Gujarat & West Bengal
- Alternatives: drip irrigation, use of biofuels

Other Issues

- De-linking land ownership and control over GW
- Separate treatment of GW and SW
 - Integrated and coordinated development
 - Conjunctive use/management
- Coordination between government agencies
 - Data collection
 - Implementation
- Need for more and better information
 - National Water Mission
 - Assessment of CC impacts on water resources – availability and quality of SW and GW
 - National Mission on Monsoon Prediction

Conclusions

- GW demand & supply concerns pre-date focused CC concerns
- Adoption of no-regrets/win-win approach
- Combination of structural and institutional measures
- Shift from management towards conservation/protection
- Improved regulation
 - Decentralization
 - Greater community involvement
- Overcome implementation challenges
- Order of priority for different GW uses
- Data collection and information generation
- Incorporation of information into laws & policies
 - Importance of political will
- Translate policy messages into binding action
- Can a law be flexible as well as certain?