Groundwater on brink of destruction

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Water stress is a major challenge faced around the world today. In a recent climate meet, 22nd Conference of Parties to the UN Framework Convention on Climate Change (UNFCC) at Marrakech, Morocco, need of water management was heavily stressed upon as the way to find sustainable solutions to climatic adversities in the days to come. In India, water resources are at great peril, especially groundwater, facing dual demons of rapid depletion and contamination. In a nationwide report on the status of groundwater resources in 2009 made by the Central Ground Water Board (CGWB), it appears that the northwestern states sit on the graver end of the spectrum with Punjab registering about 172 per cent groundwater development, followed by Delhi (138 per cent) Rajasthan (135 per cent) and Haryana (127 per cent), which urges for immediate mitigation efforts and spatially-optimised policy reforms.

What does groundwater development mean?

The meaning digs deep into the demand-supply nexus of groundwater. Practically, it can be viewed as the gap between natural replenishment and extraction (draft). In 2009, estimated "annual replenishable groundwater resources" in the state of Haryana amounted around 10.48 billion cubic meters (BCM) against a "net annual groundwater draft" of 12.43 BCM, indicating a dire state of overexploitation. And it is a thing that sweeps across entire northwest: groundwater drafting far exceeding natural replenishment. In Punjab "annual replenishable groundwater resources" vis-a-vis "annual groundwater draft" totals around 22.5 BCM and 34.6 BCM respectively, underscoring a raving deficit.

There are other states where drafting exceeds that of Haryana, such as Uttar Pradesh (annual groundwater draft: 49.5 BCM), Madhya Pradesh (17.9 BCM), Maharashtra (16.9 BCM), Gujarat (12.9 BCM), and Andhra Pradesh (14.6 BCM). But at the same time, natural replenishment of groundwater in these states far outsmarts drafting which effectively results in higher "net annual groundwater availability". For example, even though Uttar Pradesh drafts almost four times more than Haryana, it is practically compensated by about 7-fold annual replenishment as compared to Haryana.

What really sets Haryana (and Punjab) apart from rest of the lot is the projected minima of groundwater resources to meet future irrigational demands. CGWB reports reveal that in Haryana, net groundwater availability for irrigation hovers around -2.70 BCM while in Punjab it is -14.5 BCM, which implies dire groundwater shortages to be felt in the agricultural sector in the near future. It might appear ironic to think that these two states have been the epicenter of agricultural innovation in the country. Previously, Haryana's irrigational infrastructure was hinged on canal-based systems (surface water). In recent times, however, a paradigm shift made it swing more towards groundwater-based practices (wells/hand pumps).

In Haryana groundwater development is spilling over capacity in over half the districts with Kurukshetra leading the tally with 217 per cent development followed by Kaithal (212 per cent), and Gurugram (209 per cent). In Fatehabad Panipat, Sisra, Karnal, Yamunanagar, Sonipat, Rewari, Palwal, and Mahendragarh districts, it ranges between 100 and 180 per cent. There is hardly a district in the state where drafting does not exceed replenishment. There could be several reasons for this. But the most obvious is probably the uncontrolled irrigational drafting to support the Rice-Wheat Cropping System (RWCS) in the state. But as an effect, in a major part of the state, net groundwater availability for future irrigation currently runs at low negatives indicating a high likelihood of shortage in future. For a state that thrives largely on agrarian agronomy, this surely sounds the alarm. But while irrigation takes the lion's share in Haryana, potable demand bids for no lesser cut. Rural potable water infrastructure is still heavily hinged on groundwater via millions of wells and hand pumps. Overlapping spheres of two equally demanding sectors is effectively pushing the margin of groundwater resources to dangerous lows.

Added to depletion, there is the issue of widespread groundwater quality impairment by multiple pollutants: nitrate, arsenic, iron, fluoride, chloride, sulfate, salinity, pathogens…the list is just unending. Central agencies like CGWB and Central Pollution Control Board (CPCB) report that a plethora of pollutants occur way above their maximum permissible limits for drinking water standards throughout the nation. As the synergistic effect of these pollutants on public health is yet to be fully understood, using 'untreated' groundwater can pose a significant threat to sustainable human development in the days to come. Furthermore, what really rings the alarm is that groundwater contamination is almost always aggravated by depletion. So, depletion also needs to be checked in order to preserve quality and avoid health hazards.

So how to go about it?

There are two possible paths to walk. One: implement more rigorous and well-informed management strategies to conserve/protect groundwater resources; and two: carry out in-depth region-specific research to identify future hotspots of groundwater depletion/degradation. Interestingly, the former only forks out from the latter. Of course, on top of all, sustained efforts will have to be made towards developing integrated water management strategies and promote water reuse/recycling schemes, usage of water efficient fixtures, desalination, breeding drought tolerant plants, and search for alternate water sources.

As adversities posed by extreme climate events continue to drill at the very core of human subsistence, demand for freshwater resources will keep mounting in days ahead and will be quintessential to strategise sustainable development efforts. But all depends on our level of understanding of groundwater dynamics which is a highly transient space-time phenomenon. Researchers around the country are involved decoding the riddle but are continuously challenged by unavailability of free and reliable national statistics. To locate future hotspots of groundwater depletion, the research community would need accurate/updated data on soil, vegetation, land management history, geology, topography, baseflow, aquifer characteristics at various scales of space and time. But how much of these are presently available on public domains? Significant support from the government, in this regard, could be to build up an up-to-date open-source geospatial database on groundwater dynamics. But with the recent Geospatial Information Regulation Bill on the way - dropping iron curtains on easy dissemination/availability of geospatial information - will the research efforts not be only more restricted? In a country as diverse and dynamic as India, it might be easier for the government to implement sustainable protocols when they have these 'freely available' helping hands at its disposal.

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