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GUEST EDITORIAL

For a science-based transformation of water policy

India is facing a major water crisis which threatens the basic right to drinking water of the citizens; it also puts the livelihoods of millions at risk. The demands of a rapidly industrializing economy and urbanizing society come at a time when the potential for augmenting supply is limited, water tables are falling and water quality issues have increasingly come to the fore. If the current pattern of demand continues, about half of the demand for water will be unmet by 2030. As we drill deeper for water, our groundwater gets contaminated with fluoride, arsenic and uranium. Rivers and groundwater are polluted by untreated effluents, sewage and agricultural run-off that continue to be dumped into them, consequently poisoning water resources and supplies. These toxins are finding their way into plants and animals, causing severe ecological toxicity at various trophic levels. In India, cities produce nearly 40,000 million litres of sewage every day, barely 20% of which is treated. Only 2% towns have both sewerage systems and sewage treatment plants.

Our flood management strategies no longer seem to provide an adequate answer to growing flood frequency and intensity. Climate change poses fresh challenges with its impacts on the hydrologic cycle. More extreme rates of precipitation and evapo-transpiration will exacerbate impacts of floods and droughts. More intense, extreme and variable rainfall, combined with lack of proper drainage, will mean that every spell of rain becomes an urban nightmare as roads flood and dirty water enters homes and adds to the filth and disease. It is no wonder then that conflicts across competing uses and users of water are growing by the day.

Water use efficiency in agriculture, which consumes around 80% of our water resources, continues to be among the lowest in the world. The two main sources of irrigation are canals and groundwater. The relative contribution of canal irrigation has been steadily declining over time, while groundwater, especially that extracted through tubewells, has rapidly grown in significance over the last 30 years. However, the alarming fact is that both these sources of water are now beginning to hit an upper limit.

Why have we reached this point? We suggest that it is our approach to water, which has lost its necessary anchoring in the best science, that is mainly responsible for what is palpably a man-made water crisis. We must urgently recognize that we cannot do the following: (a) Control and manipulate rivers without understanding the science of river ecosystems. (b) Extract groundwater without understanding the science of hydrogeology. (c) Save our peninsular rivers from drying up if we do not understand the inverse relationship between over-extraction of groundwater and post-monsoon river flows. (d) Destroy river catchments ignoring the intricate relationship between health of watersheds and river flows. (e) Continue with 'hydro-schizophrenia', divorcing irrigation from drinking water and drinking water from sanitation. (f) Run factories without understanding the science of water footprints. (g) Manage water systems in cities without understanding the scientific relationship between water and wastewater, and the typology of diverse hydrogeological contexts in urban India. (h) Manage floods without understanding the science underlying the 'room-for-the-river' approach to flood management.

We have invested Rs 400,000 crores in large dam irrigation projects since independence. However, we continue to face successive droughts, year after year, causing great misery to millions of people, even resulting in suicides by some farmers. At the epicentre of the present droughts is Maharashtra, the state with the highest number of dams in India, but only 18% of its crop area under irrigation. Clearly, we build dams but do not ensure that water reaches the farmers for whom it is meant. India has created an irrigation potential of 113 m ha, but utilized only 89 m ha. This gap is growing by the year. By focusing our efforts on bridging this gap of 24 m ha we could add millions of hectares to irrigation at half the cost involved in irrigating through a new dam. The way to do this is to move away from a narrow focus on engineering and construction towards multi-disciplinary participatory irrigation management (PIM), which has been successfully adopted in many countries across the globe, and also in many of the command areas in Gujarat, Maharashtra, Madhya Pradesh, Bihar, Karnataka and Andhra Pradesh.

PIM implies that the states only concentrate on technically and financially complex structures, such as main systems up to secondary canals and structures at that level. Tertiary-level canals and below, minor structures and field channels are handed over to Water Users Associations (WUAs) of farmers, which enables the transformation of last-mile connectivity and adoption of sustainable agronomic practices. WUAs not only manage

water and conflicts around it, but also charge irrigation service fees, which farmers are willing to pay once they are assured of reliable and timely supply. The money is used for the operation and maintenance of the system, thus ensuring higher water-use efficiency. By bringing in the scientific disciplines of management and agronomy to the heart of command area development, we can revolutionize canal irrigation in India.

While public investments since independence have focused largely on surface water, over the last three decades, groundwater has emerged as the main source of both drinking water and irrigation, based almost entirely on private investments by millions of atomistic decision-makers. India is by far the largest and fastest growing consumer of groundwater in the world. However, groundwater is being exploited beyond sustainable levels and with an estimated 30 million groundwater structures in play, India is hurtling towards a serious crisis of over-extraction and quality deterioration of groundwater. Once again, we have ignored the science of hydrogeology, which tells us that nearly two-thirds of India's land mass is underlain by hard rock formations, with a relatively low rate of natural groundwater recharge. Using the same technology of deep drilling of tubewells across all aquifer types in India, we are close to entering a 'vicious infinite regress' scenario where an attempt to solve a problem, re-introduces it in the proposed solution. If one continues along the same lines, the initial problem will recur infinitely and will never be solved. Endless exploitation of groundwater by individuals disregards its essential common-pool resource character, leading to unsustainable use, that hurts everyone without exception. It is simply not possible to police 30 million groundwater structures through a 'licence-permit-quota raj'. What we need, therefore, is a participatory approach to sustainable and equitable groundwater management based on scientific knowledge of the storage and transmission characteristics of the underlying aquifers.

What is perhaps even more important is to view both groundwater and surface water in an integrated, holistic manner. In India today, we see repeated instances of 'hydro-schizophrenia', where the left hand of surface water does not seem to know what the right hand of groundwater is doing. India's peninsular rivers derive their post-monsoon flows from groundwater. The single most important factor explaining the drying up of these rivers is the over-extraction of groundwater in the catchments of these rivers. The drying up of base-flows of groundwater has converted so many of our 'gaining' rivers into 'losing' rivers. If river rejuvenation is indeed the key national mandate assigned to the Ministry of Water Resources, then, this cannot be done without hydrologists and hydrogeologists working together, along with social scientists, ecologists, agronomists and primary stakeholders in each river basin. By the same token, we need to protect the catchments of rivers through a multi-disciplinary watershed management programme, so that rivers and dams do not silt up before time.

In a rapidly industrializing country like India, it becomes extremely important for industry to make every effort to utilize the technologies readily available to reuse and recycle water. These technologies have incredibly low payback periods, making it in the enlightened self-interest of India's corporate sector to adopt them, especially given the fact that India has among the highest industrial water footprints in the world. India's urban areas, must ensure that they take up the treatment of wastewater whenever they aim at providing domestic water supplies. In doing so, they now have available the 21st century lower-cost options of biological treatment methods, green-bridge systems and decentralized treatment plants. They also need to map their aquifer systems so that the groundwater on which they increasingly depend can be sustainably managed.

Finally, India needs a complete relook at its flood management strategies that have thus far overly relied on building dams and constructing embankments, which appear to have only aggravated the problem. Evidence from floods in the Ghaggar River basin, both in 1993 and 2010, clearly shows the damage caused in Punjab and Haryana by breaches in embankments and unused, poorly designed and maintained canals, as also because settlements have been encouraged on flood plains and drainage lines. In 2008, a breach in an upstream embankment of the River Kosi led to nearly a thousand deaths and the displacement of around 3.35 million people. In North Bihar, despite the continued construction of embankments, the flood-prone area has increased 200% since independence, at times because embankments end up obstructing natural drainages and impede the natural building up of river deltas and flood plains.

Once again, the problem is that, in pandering to short-sighted populism, we have ignored the lessons of science. The world-over, especially in chronically low-lying, flood-prone countries like the Netherlands, for decades there has been a decisive move towards a 'room for the river' approach. We need to place far greater emphasis on rehabilitation of traditional, natural drainage systems, which would allow flood waters to navigate a safe passage through our towns and villages.

India's water has arisen out of a narrow construction–engineering–extraction-based approach to water, ignoring the basic teachings of science. Twenty-first century India calls for a new paradigm of water management based on the principles of multi-disciplinarity, people's participation and balance. Since this requires complex social mobilization and social engineering, civil society organizations will need to work in close partnership with the government, industry and scientific research organizations to achieve a real paradigm shift in water.

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