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WATER, WATER, EVERYWHERE: ASSESSING GROUNDWATER CONSERVATION METHODS AND STRATEGIES IN URBAN DELHI-NCR, INDIA

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ABSTRACT

Water has grown to be a primary source of dispute, transitioning from its position as a matter of universal human rights, to becoming luxury commodities in certain regions across the world. In developing countries, specifically, there is a need to implement solutions to the large-scale issue of water scarcity in the world: through effective engineering methodologies, structural changes to ensure apt utilization of such methods, as well as urban planning for efficient maintenance and long-term sustainability. Groundwater extraction, here is a specific matter of consideration in landlocked and highly-populated urban regions such as Delhi-NCR in India. Analysis of existing data and rainfall patterns has shown that by 2020, Delhi is likely to deplete its groundwater, if immediate steps are not taken for the same. The study will look at effective engineering tools for universal rainwater harvesting methods as well as other remedies for groundwater conservation. Alongside policy considerations, engineering solutions will be discussed keeping in mind the importance for proper groundwater development that does not degrade ecosystems or lead to the decline of water quality.

Keywords: Water, Water scarcity, Groundwater, Water conservation, Delhi-NCR

INTRODUCTION

The United Nations Millennium Development Goals emphasise the need for ground water conservation and an international consensus on the need to improve water management. Over the course of the last fifty years, groundwater development has played a fundamental role in agricultural development, in many parts of the developing world. Due to a lack of sustainable long term strategies, groundwater is depleting, while at the same time, parts of the country have not even tapped into their full development potential that groundwater could provide (Giordano and Villholth, 2007).

The problems for ground water management in the context of developing countries such as India, are unique. In the agricultural context, it is in many respects an open access resource. Management therefore involves coordination of hundreds or even thousands of individuals, and this process of management is made difficult when there is a lack of resources for basic measurement and coordination (Giordano and Villholth, 2007). In urban India, the population density, pollution and challenge of equitable distribution of resources will only mean that acute water shortage of several cities of the country will be likely to get worse over the course of time.

BACKGROUND

The government of India has stated that water conservation should be a national priority. In July, 2019, the government launched a country wide water conservation scheme focusing on 256 districts with the lowest availability of ground water. India's per capita water availability has fallen from 1,816 cubic metres in 2001, to 1,545 cubic metres in 2011 (Choudhary, 2019). It is projected to decrease further to 1,345 cubic metres per capita by the year 2025, if measures are not implemented to drastically increase the management and conservation of water. The government has attributed this situation to the over-exploitation of ground water (Choudhary, 2019). The production of food grains has increased from around 50 million tonnes in the 1950s, to about 200 million tonnes in 2000. In order to meet the population growth of the country, this would have to be raised to around 300 million tonnes by the year 2020 (Kathpalia and Kapoor, 2002).

Ground water provides 80% of India's water needs. India is now the largest user of ground water in the world, and is pumping out 25% of all the ground water extracted in the world (World Bank Group, 2019). More than half of India's districts are threatened by ground water depletion or contamination. Domestic and industrial water needs have been concentrated in or near the principal cities. This has created a tussle of equitable distribution of resources within these cities, and has also come at the cost of basic needs for rural society (Kathpalia and Kapoor, 2002). Therefore, effective water management policies need to balance urban and rural needs, as well as account for maintaining the life of river systems and other water bodies.

Since 1995, a series of World Bank supported hydrology projects – Hydrology I (1995-2003); Hydrology II (2004-2014) - have introduced systems and technology that enable reservoir managers to take crucial decisions so that their reservoirs remain full, dams remain safe, and no damage is caused downstream. Under the ongoing National Hydrology Project III (2017-2025) federal water agencies will now share critical water data with states in real time, making it transparent and accessible to all (World Bank Group, 2019).

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A study on minor irrigation schemes in India found that the rate of growth of ground water structures is slowing down. The study also found that the composition of India's ground water sector is also changing, with fewer wells being dug wells. It was also found that more than further investment, efficient usage of existing groundwater structures must be encouraged in the agricultural and industrial sectors (Mukherji, 2013).

A study conducted in New Delhi found that there has been contamination of ground water sources due to leachate generation, and landfills do not have any liners or leachate collection and treatment systems. This risks contamination when the leachate makes contact with ground water sources, especially through bore wells provided at the landfills for drawing ground water for irrigation purposes. The issue of landfills in urban areas poses a constant risk as they are sometimes in proximity to ground water aquifers or surface water bodies (Kumar and Khare, 2002). What is the need of the hour, especially in urban areas, is to ensure that the quality of the water is also maintained so that clean water is available. Therefore, strict measures need to be imposed on industries which release effluents into the water.

DISCUSSION

Given the dire situation with respect to ground water usage in the country, it is crucial to implement effective engineering solutions and longitudinal policy measures, along with structural changes in institutions in order to effectively implement these measures.

Among other measures, the government has proposed to levy a water conservation fee for ground water usage by residential complexes, industry and even for agricultural consumption. This measure has the possibility of creating a sustainable solution, and regulating unfettered usage of ground water (Economic Times, 2019).

Creating effective policy involves viewing water as a common pool resource, and not simply from the lens of agriculture of urban water supply. The current scientific literature is about hydrogeology and the mapping of water sources, but it is important to create effective policy to apply the science. This must necessarily involve bringing the resource (ground water aquifers) and communities and villages together in the processes, in a process of Participatory Ground Water Management (Kulkarni and Aslekar, 2018).

While there has been research on engineering solutions and rain water harvesting, some misconceptions about ground water management must be removed from the minds of the communities as well as organizations. The conventional thinking is that check dams would collect water that will percolate and recharge the ground water (Kulkarni and Aslekar, 2018). However, these wells do not recharge themselves, and it is the ground water aquifiers which are

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the source of the water. Groundwater aquifers are underground layers of porous and permeable rock capable of storing water and transmitting it to wells and springs. An accurate identification of aquifers would allow for accurate positioning of check dams, thereby reducing costs and ensuring optimal recharge of the water (Kulkarni and Aslekar, 2018).

It is crucial from a policy perspective for communities to have this knowledge, and for training on the theory and implications of aquifers and ground water. Imparting these hydrogeological skills to non profit organizations and rural practitioners is key to improving decentralized water management in India (Kulkarni and Aslekar, 2018). Ninety per cent of rural India's drinking water comes from ground water, and seventy five per cent of agriculture is ground water based. It is important given these statistics, that it is important to bring democratic processes to ground water management (Kathpalia and Kapoor, 2002; Kulkarni and Aslekar, 2018). Local communities in villages, towns and cities must be allowed to implement collaborative projects for conservation in a manner best suited to them.

Rain water harvesting techniques can be implemented in urban areas, as it can be done on a mass scale, with minimum expertise or knowledge of hydrogeology. The most common technique in urban areas (besides storm water management) is rooftop rainwater harvesting- rainwater is collected on the roof and transported with gutters to a storage reservoir, where it provides water at the point of consumption or is used (Gur and Spuhler, 2019). Debris, dirt, dust and droppings will collect on the roof of a building or other collection area. When the first rains arrive, this unwanted matter would be washed into the tank. This will cause contamination of the water and the quality will be reduced (Gur and Spuhler, 2019). Many RWH systems therefore incorporate a system for diverting this 'first flush' water so that it does not enter the tank. These systems are called first flush devices. for groundwater recharge. It is important from a policy perspective to spread awareness on how to implement these systems, and on different devices and filters than can be used (Gur and Spuhler, 2019).

Community participation in urban areas can better improve the efficiency of these systems, and the pooling of resources is important to obtain larger tanks, and ensure there is a monitoring system within the community to ensure the area around is kept in good sanitary condition, to prevent contamination, breeding of mosquitoes and other issues (Gur and Spuhler, 2019).

CONCLUSION

Understanding the physics of groundwater movement and measurement, the sociology of ground water users, and the political economy of water and agricultural sectors is necessary to formulate effective long term policy for ground water conservation (Giordano and Villholth, 2007). It is crucial to acknowledge the power dynamics at play in access to water around the country, in

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addition to scientific and engineering solutions. Social narratives in the country are often arranged around groundwater, with women being the ones in the household responsible for collecting water, and in urban areas, the rich getting unfettered access while it is rationed for the poor (Kulkarni and Aslekar, 2018). Therefore as mentioned above, it is important that participatory management be implemented throughout the country, rather than just the construction of infrastructure. The shift in perception from visible results to long term solutions which may not be immediately visible, is important for long term sustainability (Kulkarni and Aslekar, 2018).

People centered and managed watershed development is important to bring any engineering solutions to the public in an accessible manner. Advances in information technology must be introduced to create a modern information system promoting free exchange of data among the various agencies like the Ministries of Water Resources (MoWR), Agriculture, Environment and Forests, Urban Development and Rural Development in GoI and similar departments at the State level. MoWR may be the nodal agency for this purpose. Similarly access to this information at district, panchayat and community levels is also important (Kathpalia and Kapoor, 2002; Kulshestra, 2012).

Policies that are particularly relevant to the urban and industrial contexts are introduction of domestic water saving devices, water meters in every household, a progressive water tariff structure, auditing of water balance on each distribution system, and the segregation of sewage and other domestic use, and ensuring industrial effluents are not released into water bodies. Economic development activities including agricultural, industrial and urban areas should be planned with due regard to the constraints imposed by the water availability (Kathpalia and Kapoor, 2002). There should be water zoning of the country and the economic activities should be guided and regulated in accordance with such zoning. However, ensuring ground water supply to urban areas due to their population density must not infringe upon the rights of the rural communities and it cannot be diverted without their consent (Giordano and Villholth, 2007).

Necessary legislation must be passed by Parliament, which is an important step to ensure that engineering solutions and sustainable practices are mandated in society. The existing legislative framework provides overriding control over water resources to the state. This should be modified to provide rights to local communities, both urban and rural (Kathpalia and Kapoor, 2002). Local communities need to play a pivotal role in the management of water resources at the local level. It has also been proposed that there should be a system for collective ownership of ground water. Instead of the ownership belonging to a particular landowner, the management of ground water could be transferred to the gram sabha in a rural area, or a resident welfare association, in an

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urban area (Kathpalia and Kapoor, 2002). The higher levels of government could then provide the necessary information, and frame rules for regulation and monitoring of the situation.

There is also a need for integrated planning for utilization of water within a river basin, between rainfall, surface water and ground water. Integration must also occur between different sectoral uses and environmental requirements, between rain water harvesting structures for use of water and recharge of ground water to the high dams on the main rivers, and between different types of land use, keeping in mind the requirement of water for different uses. Besides such integrated planning, conservation through demand management, recycling and reuse after treatment, improving irrigation efficiency and then desalination of brackish or seawater and inter-basin transfers can be considered, among the steps needed to increase the availability of utilisable water (Gleeson, 2010; Kathpalia and Kapoor, 2002).

Co-ordinated development of surface water and ground water and their conjunctive use should be envisaged right from the project planning stage and should form an essential part of the project. Over exploitation of ground water should be avoided near the coast to prevent ingress of sea water into water aquifers.

It is also important for there to be a provision of accurate and up to date information on water resources in the public domain in a user-friendly form. This is essential for the rational and integrated planning of water resources in the country, for involving local communities in the task of management of water resources and for smooth resolution of water related conflicts between different parties (Kathpalia and Kapoor, 2002).

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