



Water Management in Rural India

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ABSTRACT

Achieving effective and efficient management of water is crucial for human survival and development. Of late, it has emerged as a grave global concern. The realization of the limited availability of water in space and time under conditions of population explosion and its simmering pressures in water has caused designing of 'modern' water management initiatives which are globally manufactured but implementable in local communities, India being no exception. Water management, as an integrated system based upon local knowledge and practices, is either 'non-existent' or 'irrational', 'narrowly pragmatic' and 'in the process of disappearance'. If water is a basic resource necessary for sustaining all human activities, its provision in the desired quantity and quality and at the right time and place through a workable local water management system must be regarded as an omnipresent phenomenon. Traditional knowledge informs each of these domains that are translated as practice in day-to-day life. The paper argues that the study of such systems is immensely important not only for the sake of enhancing the understanding of traditional resource management systems as situated knowledge systems and situated action locales, but also for appreciating their practical value in designing of more workable, socio-culturally viable, community-based solutions to the resource management problems encountered in recent times.

Keywords: Water Management, Rural India, Community, Water Management System, Irrigation, institution, situated knowledge, action, socio-cultural matrix, water.

INTRODUCTION

Water is the engine that drives the domestic, industrial and agricultural progress of a nation and water scarcity looming large in India has made water management a national priority. With 16 per cent of the world's population and only 4 per cent of the world's water resources, India is severely water-stressed.¹ India is home to the highest number of rural people in the world without ample access to clean drinking water (63 million people, according to Water Aid reports) and the problem is particularly rather severe in rural areas. Water levels are dropping rapidly due to over-exploitation and lack of groundwater recharging. India is the highest consumer of groundwater in the world, filling 85 per cent of rural demand (> 60% for irrigation),² consuming more than 70 per cent of what is available, and only capturing 8 per cent of rainwater. Unregulated extraction and non-replenishment has copiously caused groundwater levels to fall drastically and immensely increase its levels of salinity, chloride and fluoride.³

In addition, water contamination is an obnoxious problem, giving rise to high health and hygiene concerns. More than 70 per cent of water consumed in rural India does not meet WHO standards. Water-borne diseases such as diarrhoea, typhoid, jaundice, skeletal problems, skin allergies and urinary tract infections are rather more prevalent. Women must fetch water from a quite long distance multiple times in day, causing physical pain and spinal problems. Those in saline groundwater areas must purchase water from tankers at about Rs.1,000 per month. Water scarcity conflicts and informal water markets are on the rise and at an alarming rate. Instantaneous solutions are direly needed for these seemingly intractable problems. Access to clean and safe drinking water is a right for every Indian individual.⁴

Constitutionally, "water" is a state subject but several central government ministries have administrative cont-



rol on use and development of water resources, therefore building good governance awareness is a key component for the sustainability of any water programmes and structures. Replicable and scalable innovations include silt traps in soak pits for convenient wastewater management. Sustaining water infrastructures requires cleaning. The silt removed is used on farmers' fields for improving soil health. The other innovations are economic and efficient designs of water storage structures, the creation of freshwater pockets within saline aquifers and bio-sand filter for domestic use.

Water management traditions in rural Indian localities

Water management is a way of facilitating better use of water with frugality for reducing energy consumption. Water conservation is utmost important because fresh clean water is not only a scarce resource but also an expensive. Approximately 83 per cent of the groundwater available in India is used mostly for agriculture. The country's rainfall has not only been unevenly distributed but has also been unevenly distributed over the course of the year in relation to the temporary distribution of water. The primary source of freshwater is rainfall, it should be collected when it falls and wherever it falls, the reasoning behind conserving water.

The water management traditions in rural India can be seen as organised within small-scale village communities. These traditions embody a blend of knowledge and action as a means of fulfilling the water-related needs of the members by management of the resource and the sources through which it is harnessed. The elements of the system may be classified as falling within two basic realms, namely, the 'ideational' construct and the 'operational' aspects. The ensuing account of traditional water management system prevailing in villages of India is based upon an analytical framework comprising these integral aspects. The system may be resolved into the human and non-human components. The human component comprises the community of practitioners like water users and the managers of the system.

WATER AWARENESS IS CRITICAL

The National Institute of Rural Development and Panchayati Raj (NIRDPR), Government of India, Corporates / CSR donor communities, government, international agencies, entrepreneurs, academia, NGOs, venture capitalists, angel investors, panchayati raj institutions/rural communities and the media come together at the center to promote innovation and entrepreneurship in rural areas. Exhibits like rainwater harvesting models, technology for the creation of freshwater pockets in saline aquifers and drinking water adaptive technologies are essential. Working and demonstration models are displayed and potential collaborations are explored. These serve as capacity-building tools for rural villages from across the country.

WATER MANAGEMENT IN RURAL INDIA

Water management in rural India focuses on enhancing water security through community-led initiatives, rainwater harvesting and watershed restoration for combating depletion, pollution, and climate challenges. The efforts include constructing recharge wells, check dams, and managing greywater. Major initiatives like the Jal Jeevan Mission aim at providing piped water, while the Atal Bhujal Yojana supports sustainable groundwater management in rural areas.

Prime Water Management Activities

Groundwater Recharge: Installing recharge wells and bore wells to replenish aquifers with monsoon runoff.

Watershed Management: Creating check dams and strengthening bunds to reduce runoff and promote soil-moisture retention.

Rainwater Harvesting: Capturing rain from rooftops and open spaces for domestic and agricultural use.

Wastewater Recycling: Treating greywater for reuse in agriculture and plantation to reduce freshwater pressure.



Participatory Approaches: Engaging Village Panchayats for local water budgeting, planning, and maintenance.

RECHARGE METHODOLOGY RESTORES GROUNDWATER

Check dams

These are traditionally constructed with brick and stone masonry, are powerful local water-augmentation interventions. These barriers in watershed areas are built across the direction of water flow on shallow seasonal drains and streams. During monsoon rains, excess water is retained behind the structure and percolates into the ground to recharge the aquifer. Recharge wells are built at the basin of the check dams, which reach up to the groundwater table in order for freshwater to penetrate directly into the aquifer. Ownership and maintenance of the structures rest with the panchayat. Saline or dry wells near these check dams begin to provide freshwater. A ridge-to-valley approach is used so that the entire watershed promotes water and soil conservation. Water stream velocity is reduced using various obstacles, such as loose stone or gabion structures, before water reaches the check dam, which prevents silting of the dam's storage basin and increases its underground percolation potential.

Contour trenches

These are dug to collect and conserve runoff water and soil and to minimize silt. The key impacts of these structures include improvement of soil moisture and reduction in soil erosion in addition to groundwater recharge.

Harvesting culverts

These allow water to flow under a road, railroad, trail or similar obstruction from one side to the other. Small masonry obstacles are built on the upstream side to check the water flow to a certain level and allow it to overflow beyond that level. Collected water and water runoff percolate to recharge the groundwater.

LOCAL WATER STORAGE UNITS ARE REHABILITATED

Abandoned dry wells

These are rejuvenated when rainwater is diverted into them after passing through a desilting filter made from stones and gravel to prevent silt from entering the well. The wells can harvest a significant amount of water, since they are structurally well-connected with the aquifer. Many once-dried abandoned wells now have water because of a rise in the groundwater table.

Abandoned and underutilized traditional tanks

These are formed due to heavy silting are rejuvenated. These are critical in regions where there is no river, canal or large lake. Communities rely on groundwater and traditional tanks intended for storing rainwater for irrigation and to recharge local water sources. The fine silt deposited at the bottom of the tank prevents percolation of water into the ground and reduces the size of the storage area. The work includes desilting the tanks to increase water storage capacity, strengthen the bund, desilt water feeder channels, repair the sluice gate and overflow structure, improve the catchment area with plantation, and improvement of the overall system.

Recharge wells

These are concrete tubes in the ground designed to collect rainwater runoff from catchment areas or overflow from check dams, water channels, or rooftops during monsoons. Water is pushed underground through these recharge wells after passing through a filtration mechanism made of stones and gravel to prevent silt from



entering the well. Wells must be built deep enough to reach close to the aquifer, yet be above the water table so that the surface water can be filtered by passing thorough the soil before mixing with underground water.

Irrigation ponds

These are especially useful for villages that have saline groundwater. During the rainy season, fresh rainwater is collected from the surrounding catchment area and stored in a pond to be used for irrigation. Most of these surface water sources are seasonal, but they are important for small and marginal farmers who cannot afford to purchase water during the critical stress spells between rainfalls or during droughts. Clay content in the soil must be at least 20 per cent to hold water.

WATER COLLECTION RESTORES SUPPLY

Rainwater harvesting systems in schools

These affect school attendance, especially for girls, without water facilities for drinking or sanitation. Where groundwater is deep, rainwater from the school roof is collected into a filtering tank through interconnected pipes and stored. Water passes through bio-sand filters that remove suspended particles and bacterial contaminants from the water. Excess rooftop rainwater is diverted into a recharge well for groundwater recharging. Overflow wastewater from drinking water faucets is diverted to an underground tank for horticultural use. By creating water availability in schools, enrollment increases, academic records improve, and clean water is available for drinking and preparing midday meals, all of which result in better overall health.

A freshwater pocket within the saline aquifer

It is created by an innovative rainwater harvesting model developed by Sehgal Foundation. By extending the height and the depth of a recharge well—higher above ground, and deeper into the underground saline aquifer—hydrostatic pressure increases within the well, allowing the harvested rainwater to form a "pocket" of freshwater within the saline water. Pressure from the surrounding saline water keeps the freshwater pocket intact. A hand pump is used to extract harvested rainwater, which passes through a bio-sand filter that removes physical, suspended, and biological contaminants. This model does not require cost-intensive water storage structures. Now freshwater is available in villages that only have saline groundwater.

Community water storage tanks

These make water easily available to women (who have primary responsibility for fetching water) and generate greater awareness about the judicious use of water. Government water to the villages is erratic and travels through old, rusty pipes, leaving it unfit for drinking. Women walk two to three miles daily to fetch water from a neighbouring village with an underground sweet-water pocket. Otherwise, water has to be purchased, which is costly. The government connects water supply lines to storage tanks that collect water when the supply runs, enabling women to access water at their convenience. Water is passed through a bio-sand filter that removes biological contaminants prior to disbursal through taps.

WATER CONSERVATION IN RURAL AREAS

Water conservation in rural regions is not just about conserving water, it is ensuring water availability for secure livelihoods. Improved health and resilient agricultural systems. A reliable supply of water increases agricultural yields, enhances rural industrial initiatives and reduces rural-to-urban migration of people. Sustainable changes like rain water harvesting, reclamation of waste water and water reuse can revoutionize rural water management. Furthermore pollution control in rural areas limits contamination of drinking water sources and the proliferation of waterborne diseases. Clean, more reliable water supports entire communities, boosting the capacity for self-sufficiency amng communities.



Government Initiatives

The Indian Government along with various non-governmental organisations (NGOs) and private sector entities has taken several steps to tackle the issues of clean drinking water in India such as

National Rural Drinking Water Programme (NRDWP)

The Government of India launched the NRDWP in 2009 with the aim of providing safe and adequate drinking water to rural areas. It focuses on improving water quality and accessibility, creating sustainable water supply systems and promoting community participation in water management.

Jal Jeevan Mission

The Jal Jeevan Mission was launched in 2019 with the goal of providing piped water supply to every rural household in India. The mission also aimed at ensuring sustainability of water supply systems, promoting water conservation and management practices and creating awareness about the importance of clean water.

Rainwater Harvesting

Several NGOs and community organisations have also promoted rainwater harvesting as a sustainable solution to water scarcity. These initiatives involve building structures for collecting rainwater harvesting systems and promoting the use of groundwater recharge techniques.

Community Water Filtration System

The NGOs and private sector entities have installed community water filtration systems in areas where water quality is rather poor. These systems use technologies like reverse osmosis, ultraviolet radiation and ceramic filters for removing contaminants from water.

Water Conservation

The government and NGOs have launched awareness campaigns to encourage people to adopt practices. These campaigns encourage people to adopt practices like rainwater harvesting, drip irrigation and crop rotation for reducing water shortage.

WATER PURIFICATION IMPROVES HEALTH

Improvements to drinking water wells provide a hygienic source of drinking water for villagers in areas where wells located in the middle of agricultural fields often do not have a proper platform or parapet wall and runoff from the fields flows into the wells and contaminates the water during the rainy season. A four-foot-high masonry platform is constructed around the well with pulleys for extracting water, and a soak pit is built nearby to dispose of the wastewater that accumulates around the well.

Bio-sand filters (JalKalp) for safe drinking water is an effective, sustainable, low-cost filter based on technology invented by Dr. David Manz of University of Calgary in Canada. This technology addresses the single largest cause of ill health and death among children in India (nearly a half-million child deaths per year from diarrhoea). Poor access to potable water in villages forces people to draw drinking water from shallow hand pumps, poorly maintained stand posts, open wells, ponds, and other unhealthy water holes. JalKalp is effective against pathogens such as E. coli, total coliforms, parasites, microbes, and worms, as well as eliminating turbidity, iron, manganese, and arsenic contamination. The stainless steel filter is only 4.5 kg in weight, with no expensive parts to replace, and the cost is Rs. 3,000. The only maintenance required is intermittent cleaning of the top layer of the accumulated silt. Women are proponents of these water filters to protect their families from waterborne diseases.



WASTEWATER MANAGEMENT HALTS PATHOGEN BREEDING

Wastewater management structures are created in strategic locations to direct wastewater into the ground where it is filtered naturally before it can contaminate the groundwater.

Soak pits

These are simple, low-cost, environmentally friendly, household structures which percolate wastewater into the ground. Because they can easily become clogged with waste material. Soak pits must be closed during the heavy monsoon rain when excessive silt can accumulate. .

Soak wells

These are larger versions of soak pits which serve a cluster of households. They are constructed to take accumulated wastewater in village streets and direct the water underground after being filtered.

CAPACITY BUILDING EMPOWERS CITIZENS

. Water literacy awareness

It is critical for addressing the "low consciousness" of citizens about the overall scarcity and economic value of water, which results in its waste and inefficient use, as stressed by The National Water Policy 2012 and as evident in the villages from the absence of taps in the public water supply outlets, unrepaired leakages, and other wasteful practices. The Water Management Program begins with an action-oriented water literacy drive and periodically revisits different sections of the community, such as women, panchayats, the gram sabha, community leaders, youth, and especially with schoolchildren. Awareness rallies are conducted in the villages and government officials are invited to participate. Community radio station programming and the water management structures themselves are used as educational tools. An interactive curriculum for schoolchildren is designed around the global issues of water scarcity as well as local solutions. Raptly interested children are found to be the most effective ambassadors for carrying the message of water management to their communities, often in the form of street plays.

CONCLUSION

Water conservation and management is a really an immensely important practice for the people residing in the village areas. India has long been facing the issue of providing safe drinking water to more than 700 million people in more than 2 million villages. At present, none of these systems is functional. Water management encompasses all policies, strategies and programs for sustainably managing the freshwater natural resources, preserving the hydrosphere, and satisfying current and potential human demand. Population, household size and growth and income all decide how much water is used. Factors like climate change have increased the effect on existing groundwater sources, especially in the production and irrigation sector. Current water management activities at the village level are a perfect example of a mix of tradition and science. Almost every area in India has its unique method of storing and conserving water, which has been prevalent since time immemorial. Although some methods, such as baolis in Delhi, have long been forgotten, others, such as guls in Uttarakhand are still widely used today. Traditional methods developed and used thousands of years ago are still a way of refilling the water table at the district level. Overall, these steps indicate that India is taking measure to address the issue of clean drinking water. However more efforts are needed to ensure universal access to safe and adequate drinking water in the country

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