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FRESH WATER CHALLENGES IN KERALA

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***Abstract*:** The fresh water crisis is already evident in many parts of India, varying in scale and severity at different times of the year. There is growing concern in Kerala on availability and quality of water and deterioration of fresh water eco-systems due to natural and human activities. Population growth and changing lifestyles have created overuse of fresh water resources. The groundwater level trend during the last decade shows a conspicuous decline indicating more groundwater use in the state during the last decade. The root causes of the water crisis are mismanagement of freshwater resources, poor maintenance of the water distribution system, land reclamation, land use pattern, lack of adequate attention to water conservation, efficiency in water use, water re-use, ground water recharge and wetland conservation. Per capita availability of fresh water is decreasing day by day. Despite the current situation of crisis, indications are that the current trend is not to going to change so easily and Kerala is going to become a water scarce state by 2020.

***Keywords*:** Climate Change, Fresh water, Groundwater, Overexploitation

1. Introduction

Though water seems to be a superabundant natural resource on planet earth, water scarcity already affects each and every continent. As per WHO estimates only 0.007% of all water on earth is readily available for human usage. Moreover freshwater on earth is limited and unevenly distributed. Around 1.2 billion people live in areas of physical water scarcity, and by 2025 around 1.8 billion people will live in countries or regions with

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absolute water scarcity. Most of the water is located in the oceans that cover more than 70% of the planetary surface. Total usable freshwater supply to ecosystem from river system, lakes, wetlands, soil moisture and groundwater is less than 1% of all freshwater and only 0.01% of all the water on earth.[1]

The fresh water crisis is already evident in many parts of India, varying in scale and severity at different times of the year. There is growing concern in Kerala on availability and quality of water and deterioration of fresh water eco-systems due to natural and human activities. Population growth and changing lifestyles have created overuse of fresh water resources. Kerala, due to its greenery, water resources and copious rainfall, gives the impression that it has enough water resources for all its needs. But this is a partial truth. The groundwater level trend during the last decade shows a conspicuous decline indicating more groundwater use in the state during the last decade. Other problems on water sector in Kerala are depletion of surface water in rivers, ponds, reservoirs and other freshwater bodies, drought during summer and floods during rainy season, sea water ingress into rivers and lakes, effect of sand mining, change in land use pattern, over dependence on groundwater, less recharge, bore-well culture, and impacts of climate change. People of Kerala use lavishly water for cooking, washing clothes, gardening and car washing. The root causes of the water crisis are mismanagement of freshwater resources, poor maintenance of the water distribution system, land reclamation, land use pattern, lack of adequate attention to water conservation, efficiency in water use, water re-use, ground water recharge and wetland conservation. Per capita availability of fresh water is decreasing day by day. Despite the current situation of crisis, indications are that the current trend is not to going to change so easily and Kerala is going to become a water scarce state by 2020.

[1]William J. Cosgrove, and Frank R. Rijsberman, *World Water Vision: Making Water Everybody's Business*, New York: Routledge, 2014.

2. Fresh Waster Challenges

Fresh water is required for domestic, irrigation, industrial purposes and ecosystem maintenance. Irrigation accounts for 70% of all water withdrawals. Recently it has been recognized that natural ecosystem plays an important role in maintaining both hydrologic cycle and water quality. Leaving water to flow naturally in rivers, streams, wetland or aquifer storage was once considered as 'waste' of resources. Now the concept has been changed and priority is given for ecosystem during water allocation.

Though the Government of Kerala has provided the people with adequate water supply schemes, management of such schemes has not been undertaken effectively. This has resulted in deterioration of water supply networks throughout Kerala. People started using more groundwater to fulfil their growing requirement. Heavy withdrawal of groundwater for agriculture, industry and domestic sector has resulted deep decline in the ground water levels.

In Kerala, nearly two decades ago, groundwater use was restricted to unconfined aquifer through dug wells. In fact, common people then had enough knowledge to construct wells in the valleys, the repository zones of groundwater. The effluent water table conditions had then enabled water flow in the drainages even during lean season. Presently with the advent of technology, high-speed rigs and quality deterioration of surface water have resulted in uncontrolled exploitation of groundwater resources.[2] Little measure has been taken by the government machinery and other departments to contain the unprecedented over-draft and to bring in measures to revive the depleted groundwater resources. In many places, supply of groundwater became a lucrative business. The free and or subsidized power supply policy further aggravated the condition. There is now a 'free for all' situation as far as groundwater utilization is concerned.

[2]E. Shaji, "Groundwater Quality Management in Kerala," *Online International Interdisciplinary Research Journal* 3, 3 (2013), 63-68.

There are four major perennial rivers in the State of Kerala: the Chaliyar River in the northern part, the Bharathapuzha River and the Periyar River in the central part and the Pamba River in the southern part. Altogether, there are 41 west flowing rivers originating from the mountain ranges of the Western Ghats and draining into the Lakshadweep Sea and 3 east flowing rivers which are tributaries to the Cauveri River system. The pattern of drainage of all rivers is trellis to sub-trellis type in the mountainous upper reaches and dendritic in the lower reaches. All the rivers are in their youthful stage and are actively denuding the hill ranges and the midland region to deposit their slit loads into the Lakshadweep Sea or into back waters. The drainage patterns of all these rivers are controlled by the deformation structures in the basement rocks until the rivers reach the coastal plains. On entering the coastal plain the rivers become meandering with a very gentle gradient up to their confluence with the sea. As a result tidal effects are felt as far as 10 to 15 km in land upstream of their confluence. Almost all rives and its tributaries are fed by groundwater during summer months/non rainy seasons. As sand mining has lowered the bottom of the river channel, the base flow (groundwater flow) has increased manifold.

Excessive withdrawals of groundwater beyond the normal recharge in any given area create many harmful effects such as continuous lowering of water levels during pre-monsoon and post-monsoon,[3] lowering of pump sets, causing low efficiency, higher cost of operation, reduction of yields of wells, well interference due to close spacing of wells, and severe drinking water scarcity in summer months. Deepening of wells can cause an increase in the cost of groundwater extraction.

[3]E. Shaji, S. P. Nayagam, V. Kunhambu and D. S. Thambi, "Change in the Groundwater Scenario in Kerala over the Last Two Decades," *Journal of Geological Society of India*, Golden Jubilee Publications, 2009; Central Ground Water Board (CGWB), *Groundwater Year Book-2005-06*, CGWB, Kerala Region, Unpublished Report, 2006, 120; Central Ground Water Board (CGWB), *Dynamic Ground Water Resources of Kerala*, CGWB, Kerala Region Unpublished Report, 90.

Similarly the piezometric head of tube wells in Alleppey town show a decline trend. Since these tube wells are being pumped continuously for urban water supply this leads to some environmental problems like land subsidence.

Incidence of high fluoride is reported from Palghat[4] and Alappuzha district. Higher content of nitrate and iron is reported in groundwater in many parts of the state. Bacterial contamination is being reported from all districts in dug wells and is growing in alarming stage.

Despite numerous prohibitions and regulations, sand mining continues rapidly on the riverbed of almost all rivers of Kerala. Water tables have dropped dramatically in many places. Bharathapuzha River is today barely a trickle in the summer months. In most parts, the 209 km long river is covered with shrubs and weeds, and looks more like an unkempt ground than a water body. Unregulated sand mining has damaged the riverbed of almost all rivers. There is still no concerted movement to regulate indiscriminate sand mining.

The damage that sand mining has caused to the riverbed is not limited to a fall in the groundwater levels. The absence of sand on the riverbed affects the velocity of the water flow, making it violent during monsoons. Saline water also enters the river easily, especially in summer. Sea water ingress into the coastal aquifers due to over extraction is not reported from the Kerala Coast. However salinity is noticed in shallow wells close to the backwaters, lagoons, lakes and the tidal rivers. The rivers of Kerala often encounter salinity intrusion into their lower stretches during summer months. When the fresh water flow reduces, two major problems are encountered in these water bodies (i) salinity propagates more into the interior of the river (ii) flushing of the system becomes less effective. Both these have an impact on groundwater based water supply wells and other wells situated close to the rivers. Problems of salinity intrusion

[4]E. Shaji, J. Bindu, Viju and D. S. Thambi, "High Fluoride in Groundwater of Palghat District, Kerala," *Current Science* 92, 2 (2007), 240-245.

are also encountered in Bharathapuzha, Periyar, Meenachil and Kuttiyadi rivers

Vellayani is one of the three rainfed freshwater lakes in Kerala, the other two being Sasthamkotta Lake in Kollam and Pookkode Lake in Wayanad. Sasthamkotta Lake is in news recently on account of waste dumping and encroachment. Ravaged by pollution and land reclamation, the Vellayani freshwater lake is facing a fresh threat to its existence from illegal extraction of sand in the fallow paddy fields along its periphery. Truckloads of sand are being removed daily from the vast lowland fields that were reclaimed from the lake by local farmers for paddy cultivation. The sand extraction from the fields would destroy the aquifer layer which helps retain the water table in the lake. This would in turn affect the recharge and freshwater capacity of the lake and also lower the groundwater table in the region.

There is no restriction in digging bore wells except in critical/over exploited blocks. The open wells fitted with above 1.5 HP pumps and bore wells above 3 HP pumps should be registered in the Kerala Ground Water Authority. Normally the bore wells may not affect the open dug wells. But now the situation has changed and the pumping from bore wells badly affect the water level of dug wells. The minimum distance between 2 bore wells in hard rock areas must be 50 to 100 meters, depending upon withdrawal of ground water. However, there are no specific guidelines on spacing of wells and spacing between two bore wells at present. Indiscriminate construction of bore wells and well-interference is a big issue in Kerala.

Another problem is extracting groundwater from one area and supplying to another area through tanker lorries. This is a good business now in Kerala. People are drilling high yielding bore wells and pumping groundwater from the well and selling it. This creates problem for the adjacent well owner and the water table in general.

The recharge to groundwater has been reduced due to land reclamation and change in land use pattern. The natural water bodies like lakes, ponds, tanks, and springs are being

abandoned for developmental activities in many parts of the state. Clay mining and quarrying invites environmental problems associated with groundwater. Clay mining in Mangalapuram (Trivandrum district) has changed the land use pattern and resulted lowering of water level in the adjoining areas. Abandoning of the paddy field has strong impact on the groundwater regime. The change in land use pattern has resulted imbalance in the demand and supply of groundwater.

Another unfortunate situation is that thousands of tanks, ponds, paddy fields and springs in all districts of Kerala which helped to conserve the surface runoff and to promote the groundwater recharge, have all now been destroyed/ abandoned. There are no sufficient measures to revive these water bodies. Some measures like construction of nalla bunds, check dams, percolation tanks, sub-surface dams, etc., to revive the depleted water table may provide noticeable results only when there is systematic groundwater management.

Kerala is one among the most thickly populated state in India. As a result of the measures to satisfy the needs of the huge population, the rivers, ponds, wells, tanks and streams of Kerala have been increasingly polluted from the industrial and domestic waste and from the pesticides and fertilizers. Industries discharge hazardous pollutants like phosphates, sulphides, ammonia N, fluorides, heavy metals and insecticides into the water bodies. Recent trends of depositing the chemicals from factories, E-waste, biological wastes, etc. in open wells and ponds is alarming. Open dug wells are important groundwater extraction structures in the coastal belt of Kerala and groundwater is the most common source of drinking water in these areas. In general, groundwater quality of Kerala used to be very good. Of late, however, open wells of Kerala have the problem of bacteriological contamination and studies have shown that biological contamination is present in 95% of drinking water wells. This could be due to poor or poorly maintained sanitation facilities.

Another local groundwater problem is water logging. Water logging has developed in some areas because of excess

application of irrigation water obtained from surface-water sources. Water logging is common in Kuttanad and Kole land areas. In other areas, natural water logging problems have been intensified by irrigation practices. Water logging in the commands of major and medium irrigation projects is a known problem.

Global climate change has been identified as the most pressing environmental and economic problem facing society, and one that may prove to be humanity's greatest challenge. The environmental changes that we can expect from accelerating global climate change are sudden heavy summer rains, increase in atmospheric temperature and shift in monsoon patterns.

3. Solutions

The scientific and technical knowledge has improved the efficiency of water management and storage of fresh water, but no technology can significantly expand the basic resources available. New approaches must be developed and adopted to balance the supply and demand including improved water management and conservation, rainwater harvesting, virtual water exchange and desalination of sea water. Saving water can be achieved through the use of improved irrigation strategies and technologies. Rainwater harvesting and other water conservation techniques are well known and are being practiced generally. But we need to give attention to the following areas (distribution loss, desalination, virtual water) to address the fresh water challenge more effectively.

3.1. Minimize Distribution Loss

One of the reasons for water shortage is distribution loss of water due to poor maintenance (pipes, taps and other components) of water supply system and mismanagement. Water distribution systems connect water treatment centres to consumers and consist of pipes, valves, storage tanks reservoirs and pumps. The pipes used range from cast iron to plastic material and most of them are very old and reaching the end of their expected life span. Water distribution system, improvement/repair of supply pipes, pumps, networks, need to

be maintained and replaced at regular intervals. If we can minimize the distribution loss we may save a lot of water. Remember, distribution loss means wastage of treated water without any use.

3.2. Desalination

Desalination is the process that removes dissolved minerals from sea water to render it suitable for drinking. Desalination process may suggest the oceans are potentially inexhaustible sources of fresh water, but the process remains expensive and non-eco-friendly. The advantage of desalination is the reliability of supply that it offers and the desalination option may be chosen by the very rich more often than it is at present.

Water conservations, artificial recharge to groundwater using low cost subsurface dykes and re-use of water are the other major solutions.

4. Conclusion

The availability of fresh water results from the cycling of water (evaporation from ocean into atmosphere and precipitation from the atmosphere back to the land and oceans). The water falling over the land is stored as surface water and/or percolates down to fill underground reservoirs or aquifers. Human actions modify the hydrological cycle and can seriously pollute available freshwater. Climate change also affects the hydrological cycle significantly thereby affecting freshwater production and its distribution. The demand for water is growing day by day and the extracted volume of water from rivers and aquifers are insufficient to meet the demand. Traditionally dug wells met the drinking water needs and rivers, streams and ponds met irrigation and other needs of rural people in the state. Urban population mainly depends on piped water supply (surface water) for their needs. Now after the introduction of piped water supply to the rural area, the old village wells and other water bodies are being neglected. Presently groundwater resource of the state is facing several problems. A new approach is very much essential for the governance and conservation of groundwater resources of the state. It involves participation of local people,

NGOs, Government departments, planners, developers, Panchayath institutions and Scientists and environmentalists. However, research on groundwater use in the socioeconomic context being relatively small, the highly technical knowledge of the aquifer systems is of relatively little use for practical management purposes. Involvement of research institutions, University departments, NGOs, and other stake holders in development and management of ground water resources of the state is very much essential for adopting various water conservation techniques and ensure their adaptability in local conditions. The general attitude of the community in Kerala is that water is nature's gift and therefore be accessed free of charge, used and misused by all for whatever purposes intended. But it's high time to change our attitude towards water. Solutions are not easy but are an absolute must. It all starts with improved water management, enactment water laws and its enforcement.