Research paper *IJBARR*
Impact Factor (GIF) 0.314 *E- ISSN -2347-856X*
ISSN -2348-0653

DIMENSIONS OF WATER POLLUTION IN KERALA-THREATS AND MANAGEMENT ISSUES

Hima Hari U
Research Scholar, Department of Economics, University of Calicut, Dr.John Matthai Centre, Aranattukara, Thrissur, Kerala, India.

Abstract
Water sustains the human population and is vital for all natural ecosystems. Clean and plentiful water is the cornerstone of prosperous communities. Yet as we enter the 21st century, swelling demand and changing climate patterns are draining rivers and aquifers and pollution is threatening the quality of what remains. Any threat to this important resource, in turn threatens the ecological, social and economic foundations of the country. We face many challenges in protecting the precious water resources, now and in the future. This paper attempts to examine the water resources and its dimensions of water pollution in Kerala. Kerala, located in the humid tropics, is known for green landscape, evergreen forests, serene water bodies, rolling mountains and narrow valleys. With high rainfall, chains of backwater bodies, many rivers, reservoirs, lakes, ponds, springs and wells, the State is considered by many as the land of water. But the paradoxical situation of scarcity in the midst of plenty is the existing water situation in Kerala. 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. This study also focuses on the uses and management of water resources and suggests measures to reduce water pollution and thus make it sustainable for future generations.

Key Terms: Water Resources, Water Pollution and Water Management.

Introduction

Kerala, located in the humid tropics, is known for green landscape, evergreen forests, serene water bodies, rolling mountains and narrow valleys. Kerala State is a narrow stretch of land covering 38863 sq.km areas bordering the Lakshadweep Sea on the western side and Tamil Nadu Karnataka Station the eastern side. The length of the State from north to south is 560km and the average width is 70km with a maximum of 125km. With high rainfall, chains of backwater bodies, many rivers, reservoirs, lakes, ponds, springs and wells, the State is considered by many as the land of water. But the paradoxical situation of scarcity in the midst of plenty is the existing water situation in Kerala.

For the last three decades, Kerala is frequently facing severe droughts followed by acute drinking water scarcity. The rivers hardly contain any water during the summer months in a year; only a few reservoirs and lakes get filled up even in the monsoon and the water levels goes down to the silted up bottoms during the summer. More and more household wells and ponds are getting dry in summer. The water resource situation will be much worse in Kerala if the deficit in monsoon rainfall is very high. Changing climate patterns are threatening lakes and rivers, and key sources that we tap for drinking water are being overdrawn or tainted with pollution.

Water Resources in Kerala

Rainfall

Kerala's water resources are fully dependent on rainfall. Whereas, in addition to rainfall, most of the northern State rivers also recharged through snow melt from Mount Everest. Kerala State in the humid tropics receives an annual average rainfall of about 3062mm, which is about 2.5 times more than that of national average. The occurrence and distribution of rainfall in Kerala shows high temporal variations. South west monsoon (June to September) and North east monsoon (October to November) are the two monsoon seasons of the State of which South west monsoon is more predominant The average annual rainfall of the state is 3000mm, the bulk of which (70%) is received during the South-West monsoon which sets in by June and extends up to September.

IJBARR
E- ISSN -2347-856X
ISSN -2348-0653

Table 1, Distribution of Rainfall

Months	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	may
Rainfall(mm)	700	780	440	250	295	190	30	5	10	30	110	260

Source: Water Resource Department.

However the spatial and temporal distribution pattern is mainly responsible for the frequent floods and droughts in Kerala. The average annual rainfall in the lowland of Kerala ranges from 900mm in the south to 3500mm in the north. In the midland, annual rainfall ranges from 1400mm in the south to about 6000mm in the north. In the highland, annual rainfall varies from 2500mm in the south to about 6000mm in the north.

Rivers-Surface Water Resources

Kerala has got 41 west-flowing and 3 east-flowing were originating from the Western Ghats. The total annual yield of all these rivers together is 78.041 Million Cubic Meters (MCM) of which 70,323 MCM is in Kerala. Water from these rivers is used for irrigational purposes, drinking, hydroelectric power production etc.

The peculiarity of the rivers flowing across Kerala is short length of the river and the elevational difference between the high and the low land leading to quick flow of water collected from the river basin and quickly discharged into the Lakshadweep Sea, the state has not been able to utilize the river water sources to a major extent. The major portion of the runoff through the rivers takes place during the monsoon seasons. 67.29% of the surface water area of 3.61 lakh hectares is constituted by brackish water lakes, backwaters and estuaries.

In the all India perspective the rivers of Kerala are not so significant than even the largest of them cannot find a place among the major Indian rivers. With respect to the national norm Kerala does not have a single major river and has only four medium rivers. The combined discharge of these four rivers is less than half of that of river Krishna. The remaining forty rivers are only minor ones the combined discharge of all of them together is only about one-third of that of Godavari. Western Ghats from where the river originate is devoid of snow and therefore these river systems do not have the benefit of water supplied during the summer seasons as in the north Indian rivers.

Backwaters and Lagoons

'Backwaters' or 'Lagoons' are shallow bodies of water separated from the open sea by land. Because of this separation from the sea, Backwaters are free from the pounding action of waves. Backwaters are one of the most alluring and economically valuable features of Kerala. These include lakes and ocean inlets which stretch irregularly along the coast.. The biggest backwater is the Vembanad lake with an area of 260 sq.km.

Second comes the Ashtamudi which covers an area of 55 sq.km. Sastamkota lake is the largest natural fresh water lake of the state. It extends over an area of 4sq.km. Other important backwaters are Veli, Kadhinamkulam, Anjuthengu (Anjengo), Edava, Nadayara, Paravoor, Kayamkulam, Kodungallur (Cranganore) and Chetuva.

Ground Water Resource of Kerala

Groundwater has been the mainstay for meeting the domestic needs of more than 80% of rural and 50% of urban population besides, fulfilling the irrigation needs of around 50% of irrigated agriculture. The ease and simplicity of its extraction has played an important role in its development. Recent the problems of decline in water table, contamination of groundwater, seawater intrusion etc. are being reported at many places.

Ground Water Potential of Kerala

The ground water potential of Kerala is very low as compared to that of many other states in the country. The estimated ground water balance is 5590Mm³. Dug wells are the major ground water extraction structure in Kerala. The dug wells have a maximum depth of about 10 to 15 meters and have a diameter of about 1 to 2 meters in coastal region and 2 to 6 meters in the midland and high land. The open well density in Kerala is perhaps the

IJBARR
E- ISSN -2347-856X
ISSN -2348-0653

highest in the country – 200 wells per sq.km in the coastal region, 150 wells per sq.km in the midland and 70 wells per sq.km in the high land. The ground water withdrawal is estimated as 980Mm³ and the State Ground Water Department calculate the effective recharge as 8134 sq Mm³.The ground water level receding drastically during the summer months and drying up of wells are common features of the ground water levels in many parts of Kerala

Other Resources

Apart from rivers and wells sources like tanks, ponds, springs and surangams are also uses in Kerala for providing water for drinking as well as irrigation. It is estimated that Kerala has approximately 995tanks and ponds having more than 15000 Mm³ summer storage. Natural springs occurring in the highland regions of Kerala state have the potential to be developed as good sources for drinking water supply and also for limited small scale irrigation, especially in remote and under developed areas. A total of 236 springs have been identified in the state.

Water Pollution

Pollution of water is altering of its quality so that it becomes unfit or less fit for the purpose for which its natural state is used. Water pollution occurs when chemicals or nutrients or waste enter water faster than they can be removed by natural processes. It can be caused by biotic and abiotic contaminants. The water pollution results from point sources and non-point sources. Specific places such as sewage treatment plants and factories are point sources. They discharge pollutants into water bodies through pipes, sewers or ditches. When pollutants enter the water body not from a single source but from several points over a large area, it is a case of pollution from non-point sources. This is the case when rainwater flows across the soil, picking up pollutants and carrying them into water bodies. Non-point sources include surface run-off, mining wastes, municipal wastes, construction sediments, acid rain and soil erosion. Such pollutions are difficult to control. Laws and rules can, however, regulate the discharges from point sources.

Dimensions of Water Pollution in Kerala

Kerala is one among the most thickly populated region in the world and the population is increasing at a rate of 14% per decade. As a result of the measures to satisfy the needs of the huge population, the rivers of Kerala have been increasingly polluted from the industrial and domestic waste and from the pesticides and fertilizer in agriculture. Industries discharge hazardous pollutants like phosphates, sulphides, ammonia, fluorides, heavy metals and insecticids into the downstream reaches of the river.The river periyar and chaliyar are very good examples for the pollution due to industrial effluents. it is estimated that nearly 260 million litres of trade effluents reach the Periyar estuary daily from the Kochi industrial belt.

The major water quality problem associated with rivers of Kerala is bacteriological pollution.The assessment of river such as Chalakudy, Periyar, Muvattupuzha, Meenachil, Pamba and Achenkovil indicates that the major quality problem is due to bacteriological pollution and falls under B or C category of CPCB classification. There are local level quality problems faced by all rivers especially due to dumping of solid waste, bathing and discharge of effluents.With regard to groundwater, water quality characteristics of wells in Kerala are found to be affected by chemical and biological contaminants.The ground water quality problems in the coastal araes are mainly because of the presence of excess chloride.The chloride concentration >250mb/l was detected in the well water samples of Azhicode, Kakkathuruthy, Edathinjil, Kadalundi, Chellanum, nallalam, Mankombu and Haripad. in Alappuzha district, flouride concentration in the pumbing wells was observed to be high.In midland region, with regard to ionic concentraion, the concentration of flouride iron and chloride were found to be on the higher side.The flouride content was observed to be beyond the permissible limit of 1 mg/1.Deep wells in Chittur taluk and Knajikod areas of Palakkad district are found to contain flouride concentration greater than 1mg/l.

Sand Mining

The rivers in Kerala have been utilized largely for sand mining and seriously hammer the river eco-system. Sand mining is being permitted by the Grama Panchayats. But, more is un authourisly mined from various locations in the river course. The sand mining has resulted in lowering of the river beds in many locations, reduced the water

IJBARR
E- ISSN -2347-856X
ISSN -2348-0653

holding capacity of the river bed, resulted in bank erosion, lowering of groundwater table and drying up of wells in the nearby area. Sand mining adversely affects the diversity of life forms thriving in the riverine eco system. In the downstream areas the sand mining has lowered the riverbed even below sea level and altered the river flow and water quality. Installing electric motor pump sets to deepened wells and bore wells further add to the lowering of water table.

Open well of Kerala are under threat of bacteriological contamination. In Kerala about 60% of the population relies on ground water for drinking. At the same time studies have shown that faecal contamination is present in 90% of drinking water wells. The open character of the wells, and conventional maintenance habits, and use of buckets and rope to draw water, kitchen wastes and pit latrines with average family load factor (5 members) at a distance of less than 5 meters from wells are some of the factors, which are contributing to the bacteriological contamination .Ground water contamination due to industrial pollution has been reported from places of Kochi (eastern part of Aluva), Palakkad and some parts of Kollam, Kozhikode and Kannur.

Population growth and unplanned urbanization has contributing a lot to water pollution in Kerala. Urban sewage is an organic waste, generally released into rivers, lakes or tanks and it reduces the amount of oxygen in water. With oxygen depletion some types of fish perish in these water bodies. The utilization of ground water for irrigation, industries and drinking are very high in Kerala. The ground water levels are getting depleted at much faster rates than they can be generated.

There are other reasons for the decline of ground water

- The erratic and inadequate rainfall results in reduction in storage in surface reservoirs
- The building construction activities are sealing the permeable soil zone, reducing the area for percolation of rain water into subsurface and increase in surface runoff.
- Excessive extraction of ground water leads to the natural pollution of the same due to the digging of a large number of tube wells in Kerala.

In coastal areas, when water tables drop due to excessive extraction, there is intrusion of salt water . Salt water intrusion is affected many water supply projects. Unscientific disposal of sewage and pesticide residue from farmlands have contributed to organic pollution and chemical contamination of surface and groundwater resources in four river basins across Kerala, namely Valapattanam in Kannur, Kallada in Kollam, Keecheri-Puzhakkal in Thrissur and Chandragiri in Kasaragod district, according to a study.

An environmental monitoring programme on water quality was conducted by the Kerala State Council for Science, Technology and Environment revealed that water pollution was higher in downstream areas due to anthropogenic activities.

Water Management in Kerala

Even though Kerala has heavy rainfall it experiences water scarcity in other seasons due to poor water management. Rainwater harvesting is the viable solution in the monsoon rich state of Kerala. The The traditional water conservation structures like natural ponds, reservoirs should be desilted and cleaned. Participatory watershed development programmes should be implemented in the State. Mass awareness programme on ground water conservation should be arranged at Panchayat level in all districts.

The National Water Policy of the Government of India states that the non-conventional method for utilization of water such as through artificial recharge to ground water and traditional water conservation practices like rainwater harvesting need to be practiced to increase the utilizable water resources. The ground water storage is the best method for water harvesting as it not only involves filtration of surface but is also safe from evaporation losses, natural catastrophes etc.

Central Ground Water Board has implemented various artificial recharge schemes in Kerala like surface dykes, percolation tanks, and of top rainwater harvesting. Four sub-suface dams were constructed at Palghat district

(Anaganadi, Bhabaji Nagar, Alanallur and Ottappalam), one at Ernakulam (Odakali), one at Kottayam (Neezhir) one at Quilon (Sandanadapuram) and two at Trivandrum district (Mampazhakara and Ayiolam). Central Ground Water Board has constructed two percolation tanks, one at Chirakulam of Kottayam district and another one at Kadapallam of Kasaragod district. Roof top rainwater harvesting schemes were implemented at two places viz. Ezhimala and Mayyilcolony of Kannur district.

The Central Pollution Control Board in collaboration with Indian Institute of Technology (IIT), Delhi and with 15 other institutes has formulated criteria for Comprehensive Environmental Pollution Index (CEPI). According to the environmental assessment carried out in this regard, the industrial cluster in the Greater Kochi Area (GKA) has been identified as one of the critically polluted area in the country with CEPI score of 75.08. The Kerala State Pollution Control Board, in consultation with the industries located in GKA, has chalked out an action plan on industrial clusters in Greater Kochi area, to control and prevent pollution in accordance with the Terms of Reference suggested by the CPCB.

The main pollution sources of concern are industries, municipal solid waste, biomedical waste, e-waste and domestic waste. The action plan hence includes mainly proposal for up gradation of existing pollution control facilities in the industrial cluster areas, common facilities such as common biomedical waste management facility, municipal solid waste management, e- waste management, sewage and septage management etc. The cent per cent literacy of the State implies high level of awareness and media attention, resulting in higher expectation of maintenance of environmental wholesomeness..Considering the unique characteristics of Kerala, and the frequent deficit in monsoon rainfall, the State has to formulate strategies to mitigate drought situation in the State.

Measures to Conserve Water

A person requires 135 Litres of water per day in India according to Central Public Health and Environmental Engineering Organisation.

Table 2 Average Use of Water per Day in India

Uses	Cleaning of houses	Flushing Latrines	Washing Utensils	Bathing	Washing Clothes	Cooking	Drinking
Litres	10	30	10	55	20	5	5

Source: Central Public Health and Environmental Engineering Organization.

The major steps an individual can take for sustainable management of water

- Reducing water consumption
- Improving water efficiency in homes and buildings
- By installing efficient water fixtures like dual-flush toilets, aerator taps, efficient showers, waterless urinals etc and regularly checking for leaks households can reduce daily percapita water use by 35 % according to the American Water Works Association.
- Use decentralized waste water recycling systems in houses and buildings using natural methods like planted filters
- Reduce industrial consumption through recycling, reuse and new water efficient technologies.
- Implement rainwater harvesting in rural and urban areas
- Adopt agricultural practices that require less water
- Replace water hungry crops by those that require less water
- Promote crops that can tolerate salty water
- Return to indigenous species that can withstand drought
- Switch to organic and natural farming
- Get more crop per drop-Use drip irrigation, precision sprinkler method etc.
- Adopt fairer policies by the government
- Give communities control over local water sources

- Price water properly
- Remove inequities in access to water
- Adopt decentralized system of water supply and sanitation.
- Dumping of industrial waste and sewage has to be reduced through proper legislation for the preservation of water resources.
- Making awareness among people about the scarcity of water
- Observe World Water Day by focusing school children and the youth

Water sustains the human population and is vital for all natural ecosystems. Clean and plentiful water is the cornerstone of prosperous communities. Yet as we enter the 21st century, swelling demand and changing climate patterns are draining rivers and aquifers and pollution is threatening the quality of what remains. Any threat to this important resource, in turn threatens the ecological, social and economic foundations of the country. We face many challenges in protecting the precious water resources, now and in the future. It is clear that water scarcity will soon hit most countries, unless immediate remedial measures are taken. Thus, it is necessary and important to guarantee water availability overtime by means of sustainable forms of management, which will allow countries to cope with present demands without jeopardizing environmental balance and the needs of future generations.

References

1. Shaji E, Bindu J Viju and Thambi D S, (2007),*"High fluoride in groundwater of Palghat district, Kerala"* Current Science, Vol. 92, 2, pp 240–245
2. Shaji E, Nayagam S P, Kunhambu V and Thambi D S, (2009)," *Change in the Groundwater Scenario in Kerala"*.
3. Ullas T, Mahvish Anjum," Population Growth and Environmental Impacts in Kerala" *IOSR Journal of Humanities and Social Science (JHSS) Volume 6, Issue 1(Nov. - Dec. 2012), PP 34-38.*
4. Shaji E ,*"Groundwater quality of Kerala – Are we on the brink?" Disaster, Risk and Vulnerablity Conference 2011 School of Environmental Sciences, Mahatma Gandhi University, India in association with the Applied Geo informatics for Society and Environment, Germany March 12–14, 2011.*
5. Economic review, *State Planning Board Kerala 2013.*
6. *Kerala State Water policy 2008.*
7. James E J, (1999), "*Water Resources of Kerala, Status, Problems and Future strategies Proceedings" Public Hearing on Environment and Development, PCED.*