Participatory well recharge programme for sustainable water management – The Kerala experience

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Abstract

Kerala is bountifully blessed by Nature with an annual rainfall of 3100 mm, which is around 3 times the Indian national average, numerous water bodies and 44 rivers. This has given a false impression that Kerala is a water surplus state. In spite of 44 rivers and world's largest water well density (there were nearly 70 lakh wells in Kerala in 2008, their number growing at 3.31% annually- CWRDM) , per capita surface water and groundwater availability of the state is lower than that of arid states of India. Moreover, Kerala has one of the lowest per capita rainwater availability in the Indian sub-continent and it is still decreasing over the time. The problem of water scarcity arises due to the state's peculiar topography, characterised by the narrow stretch of undulating terrain that extends from the Western Ghats to the Arabian Sea, the high run off leads to most of the water flowing to the sea at a high pace. Therefore, the actual water available for consumption is extremely low compared to the rainfall that it gets. This coupled with high density of population and an urban-rural continuum that almost stretches through the entire state makes Kerala a water-deficit state. The easiest and most cost effective way for a sustainable water management for Kerala is to recharge the wells through rain water harvesting. The present study examines the well recharging programmes in Kerala taking Mazhapolima as a case. Mazhappolima is a participatory well recharge programme initiated by the district administration of Thrissur district in Kerala in collaboration with panchayati raj institutions, envisages recharging of about 4.5 lakh open wells in the district to ensure sustainable access to drinking water. The project launched in 2008 has proved to be successful for recharging wells and managing rain water.

The water situation in Kerala is marked by contrasts. On the one hand, Kerala has plenty of rivers, lakes, ponds and brackish water and receives two monsoons, but on the other hand, it is a water stressed state with water availability per capita being lower than that of Rajasthan. (Government of Kerala)

Introduction

Rain is the primary source of water on our planet earth. All the secondary sources of water like rivers, lakes and wells on which we depend mainly to meet our water requirements are fed by rains. Kerala is abundantly blessed by nature with an annual rainfall of 3100 mm, 44 rivers and numerous water bodies. Since Kerala lies along the Arabian Sea, it is the first state in India to receive the monsoon rains, both the southwest and the northeast monsoons. However the geographical and topographical factors places Kerala at a disadvantage in preserving the water available from rainfall. Due to the slope of the terrain, the water from the rain runs off fast to reach the Arabian Sea within hours of rainfall. Added to this, the wetlands and paddy fields were filled up for commercial purposes on a large scale.Kerala has also mismanaged its natural resources and failed to check deforestation, sand mining and pollution in almost all its rivers. Depletion of vegetation cover, pollution of water from different sources, soil erosion and recession of water table has become common in many catchments. These factors have a pronounced impact in Kerala. The high population density, centralized rainy Season, less scope for water recharging, conversion of paddy fields and low lying areas are the major reasons for the water scarcity prevalent in Kerala.

Water Sources

The water resource scenario of Kerala is peculiar with characteristics of rain abundance and water scarcity. Kerala is well known for its plentiful rainfall, perennial springs, rivers, lakes and other water bodies. Kerala has 44 rivers, all of which originate in the Western Ghats. None of them are major rivers and only four are classified as medium rivers. All these rivers are rain-fed (unlike rivers in North India that originate in the glaciers), which means that Kerala is heavily dependent on the monsoon. However , the per capita availability of water in Kerala is substantially lower than the national average. Per capita rain water availability is also below the national average. Even though the state gets 3100 mm of rains on an average in a year, accelerated run off to the sea leaves very little water behind. Bulk of the rainfall in Kerala is received during the South-West monsoon (70%) which sets in by June and extends up to September . The state also gets rains from the North-East monsoon during October to December . However the spatial and temporal distribution pattern is mainly responsible for the frequent floods and droughts in Kerala. However, the state's peculiar topography, characterized by the narrow stretch of undulating terrain that extends from the Western Ghats to the Arabian sea, triggers high run off which leads to the draining away of a major portion of the water to the sea at a higher pace. Thus, the actual water available for consumption is extremely low compared to the rainfall that it receives. Many parts of the State still remain drought affected. A large number of households still don't have proper access to clean and safe water. The high density of population worsens the situation. There is still acute water scarcity.

Reasons behind Water Scarcity in Kerala are numerous. Increased population density is one of the factors that have contributed to water scarcity. Emergence of nuclear family system has fragmented many cultivable lands into small pieces of 0.10 to 0.20 acres. These fragmented lands of agriculture give little scope for the water conservation practice of traditional agriculture. Ponds were levelled to sell off land and perennial open wells often converted to deep toilet pits. Levelling of paddy fields for house constructions destroyed the natural eco system. This led to uncontrolled sand mining from rivers, for house and other construction works. Consequently, open wells near to the rivers depleted. And further, levelled paddy lands gave scope for floods as well. Farmer's collective efforts in the form of cleaning ponds, building minor earthen check dams across the streams at the end of monsoons and other similar activities are now termed as the duties of local governments.

Water Management

The challenge in Kerala is mainly the management of water and waste management. The strategy should be one of sustainable integrated management of water in all areas. Water needs to be conserved and valued. Recovering, recycling and re-using of water is the sustainable way out. New technologies will have to be adopted both on the supply and demand side for using water in a conservative fashion. The demand for water emanates from irrigation, domestic use for humans and animals, industrial use and environmental purposes, such as removal of soil salinity.

Much of the enormous water resources remain unutilized and most of the natural ponds and lakes are getting dried up due to absence of proper water resource planning and scientific management. Efficient utilization and management of available rainwater along with recharge options is the core issue if the cropping intensity and production is to be enhanced. Rain Catchment is a viable solution for any area facing water shortage. Rain Catchment Systems require no electricity and are fairly simple to trouble shoot. They can be installed in the most rural areas and can be made from the most primitive materials. A Rain Catchment System can be as simple as a small swale to stop water flooding off a slope or as integrated as a system that catches rain to supply a structure with water for drinking, sanitation or agriculture. One thing is certain; Saving the Rain can put an end to the water crisis.

Most of the families depend on private water sources, which are usually open wells. Many of these wells dry up by early March and remain so till the monsoons, which are in May - June. Before introduction of public water supply systems by modern governments, open dug wells were the main source of drinking and domestic water supply in Kerala. This means more than 95% of the water needs of households were met from the open dug wells. Whereas this has reduced drastically ignoring wells for pipe water supply systems. As per the 2001 India Census data, 72% of the households in Kerala were depending upon open dug wells and it reduced to 62% in 2011 Census data figures. This is alarming and causes concern for the water security systems in the state. The problems faced by the open dug wells invariably the depletion of ground water table particularly in summer and depletion of ground water quality.

Groundwater Management:

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. Central Ground Water Board has implemented various artificial recharge schemes in Kerala like surface dykes, percolation tanks, and of top rainwater harvesting. Four sub-surface 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 artificial recharge structures have given satisfactory results and the groundwater condition in the area has improved considerably.

Rainwater harvesting is the viable solution in the monsoon rich state of Kerala. The common structures feasible for Kerala are sub-surface dykes, nala bunds, check dams. The traditional water conservation structures like natural ponds, reservoirs should be desalted 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.

Rain water Harvesting

Rainwater harvesting, in its broadest sense, is a technology used for collecting and storing rainwater for human use from rooftops, land surfaces or rock catchments using simple techniques such as jars and pots as well as engineered techniques. Rain water harvesting has been practiced for more than 4,000 years, owing to the temporal and spatial variability of rainfall. It is an important water source in many areas with significant rainfall but lacking any kind of conventional, centralised supply system. It is also a good option in areas where good quality fresh surface water or groundwater is lacking. The application of appropriate rainwater harvesting technology is important for the utilisation of rainwater as a water resource.

Rainwater harvesting can be implemented as a viable alternative to conventional water supply or on-farm irrigation projects considering the fact that any land anywhere can be used to harvest rainwater. Rainwater harvesting, irrespective of the technology used, essentially means harvesting and storing water in days of abundance, for use in lean days. Storing of rainwater can be done in two ways; (i) storing in an artificial storage and (ii) in the soil media as groundwater. The former is more specifically called roof water harvesting and is rather a temporary measure, focusing on human needs providing immediate relief from drinking water scarcity, while the latter has the potential to provide sustainable relief from water scarcity, addressing the needs of all living classes in nature. Through the proposed individual rainwater harvesting, units will be made available to the beneficiaries. The rainwater or runoff in the form of a spring or stream can be harvested using simple and eco-friendly low-cost technologies such as UV resistant plastic lined ponds, ferro-cement tanks etc or it can be soaked into the soil to recharge aquifer. The rainwater harvesting technology in UV resistant plastic lined ponds is found to be very simple and economical and ensures effective storage of harvested water by hindering seepage losses. The studies suggested that these technologies are sustainable, locally adoptable, cost-effective and affordable to the farmers.

Rainwater harvesting systems can provide water at or near the point where water is needed or used. The systems can be both owner and utility operated and managed. Rainwater collected using existing structures (i.e., rooftops, parking lots, playgrounds, parks, ponds, flood plains, etc.), has few negative environmental impacts compared to other technologies for water resources development. Rainwater is relatively clean and the quality is usually acceptable for many purposes with little or even no treatment. The physical and chemical properties of rainwater are usually superior to sources of groundwater that may have been subjected to contamination.

Rain water harvesting in Kerala

Rain water harvesting has gained popularity in Kerala through various projects implemented by different agencies. The Rain Water Harvesting Campaign of the Government and publicity by various media are responsible for popularizing rain water harvesting in the state. Rainwater harvesting is viewed as a water security measure for the State of Kerala, with two broad types of programmes. Various local governments have tried various water related projects including those from KWA and Jalanidhi. The introduction of Jalanidhi water scheme in Kerala sought to help villages plagued by chronic water shortages, making special provisions to include vulnerable people such as tribals, scheduled caste communities as well as fisher −folk within the project's ambit. Small groups of households who wanted better water supply were helped to come together to build and run their own water supply schemes. They were helped to dig new wells (to tap into the upper layers of water) drill bore −wells (to tap into deeper aquifers), or build systems to draw water from the state's numerous springs, streams, rivers and lakes. They were also helped to build storage tanks and lay down pipes to distribute water to village homes. While the state government bore the lion's share of capital expenditure (75%), the gram panchayat paid 10 per cent, and the beneficiaries themselves 15 per cent .The operations and management also lies with the beneficiary groups. Community groups determined the timings and duration of water supply to member families, and levied service charges to meet their operation and maintenance expenses.

Case Study

Mazhapolima- Rain water harvesting programme in Thrissur District, Kerala

The Thrissur District Administration together with the Panchayathi Raj Institutions (Local Self Governments) of the district in 2008 jointly launched a well recharge programme through roof rainwater harvesting by name, 'Mazhapolima' means "bountiful rain" . Mazhapolima is a community based well recharge programme. Networking NGOs/CBOs, households, departments and agencies, research institutions, private sector and all other key stakeholders, either as water user or as water provider/planner is fundamental to the programme. Diversity of approaches and implementation arrangements according to location specific needs centred on sustainable outcome and service levels are the underlying tenets of the programme.

The relevance of this well recharge programme in Thrissur district is on the following grounds; Thrissur district has one ground water over-exploited block / Region (Kodungalloor) and four semi-critical blocks in ground water over draft terms (Mala, Mathilakam, Ollukkara and Thalikulam).

- 75% of 4.5 lakh wells in the district are seasonal Wells and is indicative of the quantitative scarcity of water .
- There are incidences of salinity intrusion into the Low-land and Midland interface area, adding a dimension of qualitative problems even where ground water table is high. This is a qualitativedimension of water crisis.
- Drought and drinking water scarcity causes heavy expenditure on the public exchequer as Government has to arrange Tanker lorry water supply in large parts of the District during drought periods. The district is spending more than Rs. 100 lakhs every year for supply of water in tanker Lorries.

The technology adopted for the Mazhapolima programme is mainly roof water harvesting for open well recharging. As mentioned earlier, households in Kerala mainly depend upon homestead open dug wells for their domestic water needs than the inefficient public water supply systems. However, ground water depletion in general calls forth large scale replenishment of unconfined aquifers from where open dug wells make avail water in Kerala.

Mazhapolima programme offers a set of cost effective choices for the community, mainly based on traditional methods and proven choices as shown in Table 1:

Table 1: Technology Options

Technology choice	Specification	Indicative Cost in Rs
1. Roof top harvest with Sand filter	PVC Gutters pipes are fixed to collect water from roof and water is diverted to the filter using a PVC pipe. The filter consists of sand, metal and charcoal	6000
2. Roof top harvest with ordinary Nylon filter	Water is harvested from the roof and isdiverted to the well through a Nylon orcloth filter using a PVC pipe.	4500

Source: Mazhapolima office

Approach and Strategy of Mazhapolima programme

The strategy of implementation of the programme Mazhapolima is as follows.

1. Community Driven: The programme is tailored to trigger the community strengths, social capital, traditional wisdom and focus on "Investing in Common Future" 2.Participatory approach: As water is everybody's business, the programme envisages partnership, collaboration and synergy of all stakeholders, private, public and NGOs.

3. Demand Driven: The programme is bottom up and demand driven. There exists tremendous pent up demand in service level (quantity), quality and such demand isconverted into willingness to make cost effective and minor investments to reap rich dividends.

4. PRI Centric: Water is a mandate of the PRIs. The programme supports them effectively discharge their mandate by harnessing community initiatives and leveraging investments at their own disposal for common benefit. Ground water is our common pool resource and investments made are undoubtedly for public welfare. This also entails vital responsibility on the PRIs, in participatory planning /management and effective regulation of ground water usage.

Implementation Process

Harvesting roof water and its diversion to open dug well is the key tool in the programme. It is envisaged as a collective and collaborative programme of the local governments, NGOs, Development Activists, Scientists, Rural Libraries and Recreation clubs of the District. Governmental assistance to the beneficiaries under Mazhapolima is limited to socially and economically backward category of households, scheduled castes,Scheduled Tribes and households Below Poverty Line (BPL). The beneficiaries are selected by the local governments.

A total of 20000 plus household well recharges have been completed under Mazhapolima project in which 13206 units are with Government Subsidy .

Table 2: Number of installed units (with government subsidy)

Sl.no.	Area	No of installed units
1	High land area	4246
2	Mid land area	4258
3	Coastal area	4566
4	Institutions	132
	Total	13206

Source: Mazhapolima office

Objective of the study

To assess the impact of Mazhapolima programme in solving water scarcity in the study area. The study will also assess the social and cultural acceptability of recharge schemes to the beneficiary communities, and their suitability for community participation in planning, construction, operation and maintenance needs.

Data and methodology

The district of Thrissur has three distinct geographical zones, the low lands (costal belt), the mid lands and the high lands. Since the availability of water and its quality vary considerably between these regions, for a correct assessment of the programme data has to be collected from all the three regions. So the present study one panchayat from each of the three zonesfrom Thrissur district where Mazhapolima programme was implemented. Study Area I (SA 1) belongs to the low lands, Study Area II (SA 2) belongs to themid lands and Study Area III (SA 3) belongs to the high lands. Data were collected from 50 households from each study area using a schedule which enquired into the effectiveness of the Mazhapolima programme.

Analysis

In low land area (SA1) 78% of the respondents were of the opinion that there is significant improvement is in the groundwater availability after Mazhapolima programme was implemented. In mid land area (SA2) 81% of the respondents were of the opinion that there is significant improvement is in the groundwater availability after Mazhapolima programme was implemented. However in the highland areas (SA 3) only 42 % of the respondents opined that there is significant improvement in the groundwater availability after implementation. In the highland area the improvement in groundwater availability was thus marginal compared to other regions.

The study enquired whether changes in water resource availability and access through Mazhapolima programme have affected people's production and income. In SA 1, 73%, in SA 2, 53% and in SA 3, 38% of the respondents reported that changes in water resource availability and access has improved their production and income. This is basically by cutting down the time and money spend for water collection during summer season and other periods when there is water scarcity. The study could also observe that these effects are distributed between different social groups differently. In all the study areas the households belonging to the low income categories reported the maximum benefit. Similarly the households engaged in primary sector occupations also reported the maximum benefit.

The gender dimension of the Mazhapolima programme is to be noted separately. The maximum benefit of the programme was reported by women. Though this was expressed by the respondents in all the study areas, the study could observe some variation across study areas.

One problem faced by the respondents was the maintenance of the system. The most commonly encountered operational problems are i) Mud balls and other dust / leaves blocking the filters and ii) Cracking of filters. 70% of the respondents are of the opinion that proper maintenance of the rain water harvesting system is highly essential for the better functioning of the system. Majority of the respondents (85%) has the opinion that there is a need for periodic maintenance of the recharge systems, usage of quality materials, and ensuring beneficiary participation in the implementation of well recharge system for deriving better results.

Conclusion

70% of the population in Thrissur district depend on an approximate 4.5 lakh open wells for their domestic water needs. A vast percentage of these wells are non-perennial and unsustainable. 'Mazhapolima well recharge' made an attempt to recharge these wells and make these sustainable both in terms of quality and quantity.

This programme witnessed a successful shift from the conventional large scale government projects towards a community based small scale eco-friendly project. Mazhapolima project was launched as a lasting solution to the recurring acute water scarcity in Thrissur district during summer.

The Mazhapolima programme has brought positive changes in water resource availability and access and have brought in water security in all the study areas, though there are marginal variations across regions.

The study has revealed that direct well recharge by rainfall harvested from rooftops is augmenting the groundwater reservoir, and also improving the water quality. Beneficiary participation has to be ensured in the implementation and the periodic maintenance for deriving better results and the sustainability of Mazhapolima project.

The Mazhapolima Experiment in Thrissur leaves the following lessons for water management projects managed by local self-governments.

1. Water has an economic value in all its competing uses and should be recognized as an economic good. Failure to recognize the economic value of water in the past has led to wasteful and environmentally damaging uses of the resource. Managing water as an economic good is an important way of achieving efficient and equitable use, and of encouraging conservation and protection of water resources.

2. Water development and management should be based on a participatory approach, involving users, planners and policy-makers at all levels.The participatory approach involves raising awareness of the importance of water among policy-makers and the general public. It means that decisions are taken at the lowest appropriate level, with full public consultation and involvement of users in the planning and implementation of water projects.

3. Women play a central part in the provision, management and safeguarding of water. This requires policies to address women's specific needs and to equip and empower women to participate at all levels in water resources programmes, including decision-making and implementation, in ways defined by them.

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