Issue Brief

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Drought Relief: Harnessing Native Genius for Water Storage

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ISSUE BRIEF

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ABSTRACT

Droughts draw attention to failure of government supply programmes. With each passing year the severity of the water crisis worsens. At fault is an engineering-heavy, centralised approach that ignores a basic fact about water – its use is distributed across diverse terrain and so it makes sense for the resource to be conserved locally. Large schemes channelling water over long distances are expensive, wasteful and lead to conflicts. This Issue Brief explores alternatives that rely on government or NGO interventions to augment local water resources. A key outcome of involving people in finding community-based solutions is that over time they gain the confidence and expertise to manage their water resources.

The Issue Brief argues for a paradigm shift in water management away from the large to the small that can be owned and managed by the people who use the water. It draws from successful examples of Indian local initiatives in water management in Kerala, pre-bifurcation Andhra Pradesh, and Rajasthan. Such models, the author says, could be scaled up rapidly with local adaptations, rather than a one-size-fits-all approach, with specific roles for governments, civil society, and industry.

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I. INTRODUCTION

At a time of drought, defined as deficient precipitation, it is easy to push through fanciful solutions. Heavy on engineering and short on intelligent water management, ideas like linking rivers such as the Ken and Betwa (National Water Development Authority, Government of India, 2006) appeal to proponents of big projects. Others like building more large and medium dams and barrages are equally appealing. People-oriented, simple, ways to augment local water availability are lowest in priority.

This stems from the way decisions are taken in India. It also speaks to the infrastructure-oriented way of planning and execution of any public works. Approaches that involve giving people a say in planning or that give them control over a resource as contentious as water get short shrift; they are denigrated as an activity of digging and filling holes in villages.

In the case of water conservation, it makes more sense to promote small, distributed systems rather than large, centralised networks. Rainfall and the use of water are unevenly distributed; in other words, water use is a scattered activity. The largest user, agriculture, uses it to irrigate fields that are scattered over a large area. In rural India, villages and hamlets are also scattered with varying demands for drinking water. Laying pipes or building canals for conveying water over large distances from a central source such as a dam makes less economic sense than building smaller storages at many locations. These take the source closer to the user.

Thousands of ponds

For this, take a look at the rural scenario. There are 103,878 ponds (Minor Irrigation Census, 2006-07) of varying sizes with a rough aggregated storage capacity of 367,662,000 cubic metres. This is the annual replenishable surface water resource not stored in large, medium or small dams. The advantages of maximising this is that this resource is easily accessible, recharges groundwater and is cheap and easy to maintain. Therefore, it makes sense, 1) to strategically develop, renovate or expand the enormous numbers of village and urban ponds, and 2) to maximise water conservation in common areas – 'wastelands', forests, hilly terrain and any other common space by watershed treatment. Check dams, gabions, sand dams, recharge pits, contour bunds … the list of such options is long and varied.

Rainwater harvesting is practised across India. In Rajasthan it is used for both drinking and irrigation. In most other parts of the country it is used for irrigation. It is critical for recharging groundwater but this has got scant attention from public and policy-makers alike.

This Issue Brief examines rainwater harvesting in three different locations of India to show how simple inexpensive techniques make for water security.

II. THE MANY WELLS OF KERALA

Kerala is a land of paradoxes, where rainfall exceeds 3 metres a year and there is a drought every summer. Where nearly all people have their own toilets and water is laced with bacteria from human excreta. It is one large city from its southernmost to its northernmost tips, the sole exceptions being the beauteous mountains. It is also the only Indian State with the human development indices of a developed country.

The challenges

Thrissur district in the central part of Kerala has hills on the east and the Arabian Sea on the west. Each summer, wells dry up and people call in tankers. In the coastal areas, the groundwater is saline as sea water has entered the aquifers. In the mid-altitudes, water quality is compromised by untreated sewage from towns and villages as well as leachates from pit toilets. In rural areas, households are far apart making piped water schemes costly. People use their wells as the universal water source. In urban areas, tankers and the local river are the fall back options.

In a few panchayats like the Adat Gram Panchayat (GP), about 12 km from Thrissur, tubewells have been installed to supply water during the summer months. However, the water from these has a high content of iron that spoils the taste and stains clothes. Additionally, there are concerns about rapidly depleting aquifers because of urbanisation. This pattern is repeated across the other GPs in the Thrissur district. People grow rice in low-lying coastal areas from where they pump out excess water during the rains; this has exacerbated the decline in aquifers.

On the other hand, during the monsoons, parts of the district get flooded or water logged. Most of the rain washes off into the sea, taking the rich topsoil with it. For a few months, the soil retains the water and wells are full before the cycle starts again.

The approach

Concerned by recurrent droughts from March to May every year, the administration of the Thrissur district decided to do something different. The administration had to call in hundreds of tankers to provide water at huge expense. This irked the then (2008) District Collector, V. Kurian Baby.

Baby consulted with local experts and devised a simple solution – channel the abundant rainfall into wells that are ubiquitous in Kerala. Thrissur has 450,000 wells and the State, about 10 times

that number. They represent the State's collective investment in water security as over 70 per cent use well water for all their needs.

Baby puts the value of this investment at over Rs. 1,800 crore, all private. The Kerala Government in the vote-on-account for 2016-17 has set aside Rs 90 crore for Mazhapolima, the rainwater-linked well recharge scheme. A Government Order in February specified the institutional structure for running the project: a State-level monitoring committee headed by the Principal Secretary for Local Self-Government, district committees headed by the District Collector for planning, and panchayat committees for implementation.

Why it worked

This approach integrates water security with livelihoods. In panchayats, the core group is formed by the State women's self-help group (SHG) organisation called Kudumbashree, the sarpanch and other officials. There are technical experts to support individual households. Linking with Kudumbashree helps poor families access credit. People can use funds from the Mahatma Gandhi National Rural Employment Guarantee Scheme (MGNREGS) for materials and labour.

The basic tenets of the scheme are simple. Collect rainwater from the rooftop, run it through a sand filter and then into the well on the homestead. PVC pipes are slit in half and fixed to the rafters protruding from the edges of roofs. These are connected to a common descending pipe that lead into a sand pit. From there another pipe takes the water into the well.

However, the tropical sun destroyed the PVC pipes used initially, necessitating replacement with U-PVC pipes (stabilised to handle ultra-violet solar radiation). The cost was Rs. 5,000 per household for the pipes and other material. Householders do the work themselves with hired help if needed. It takes less than a week to set up a system for a typical Kerala house. The catchment is ready-made with tiled roofs on most homes.

The journey from experiment to policy has been long. In 2008, a United Nations-sponsored platform for collaborative knowledge -building called 'Solution Exchange' ran an e-discussion on Mazhapolima (Solution Exchange for the Water Community, 2008). The idea was to seek ways to popularise the programme and innovative ways to finance it. Mazhapolima captured the national imagination as a way to address annual droughts in many parts of the country.

The following year, Solution Exchange and the Thrissur administration conducted a workshop on water issues in South India. The then Principal Secretary for revenue and disaster management, Nivedita Haran, announced that the Kerala Government would give Rs. one crore to the district. In 2013, another Rs. two crore was announced for the programme.

Mazhapolima has worked because it uses these principles:

Community Driven and participatory: Leverage community strengths, social capital, traditional wisdom and focus on "Investing in Common Future". People have to be part of the programme as water is everybody's business

Demand Driven: Mazhapolima is bottom up and demand driven. It taps into the pent up demand in service level (quantity), quality and such demand is converted into willingness to make cost effective and minor investments to reap rich dividends

Panchayat Centric: Water is a mandate of the Panchayati Raj Institutions (PRIs). The programme supports them to address this by harnessing community initiatives and leveraging investments. Each GP in the district has about 4,500 open wells and about 6,000 households on an average. Recharging wells would be one of the most effective ways to reach out to the people which will have sustainable welfare impact.

Role of the State government: The Government facilitates the process by helping in planning, technical guidance, implementation and monitoring.

Process Oriented: The programme encourages innovation and diversity. GPs develop their own projects with local technology according to need, costs and capacity, helped by a technical team.

Cost Effective: Considering the overall impact on quantity of water harvested in volume, these solutions would be the most cost-effective, made possible by employing local material and labour available.

Campaign Mode: As the basic approach is participatory and demand driven, the success of the programme is possible only through a campaign mode in generating awareness, demand and sustained enthusiasm.

Impact: Ground water levels have improved significantly in Thrissur. The larger twin benefits of improving quality and quantity will become apparent after rainfall has been channelled into wells across the state.

However, early studies point to a worryingly high persistence of bacterial contamination in groundwater. This comes mostly from pit toilets near the wells owing to the high porosity of the soil. While there is a good demand from some areas for the project, others have yet to show enthusiasm. Where demand is high, the project has also helped people leverage other government schemes through social capital built for Mazhapolima.

III. GROUNDWATER, THE INVISIBLE FOUNDATION

Groundwater is the bedrock of India's civilisation. With more than 60 per cent of irrigated agriculture and 85 per cent of drinking water supplies dependent on it, groundwater is a vital resource for rural areas in India (The World Bank, 2010). This reservoir is dwindling fast with some 30 million drillings across India. The concentration of drilling is higher in drier parts of the country given the scarcity of rain.

The Deccan Plateau is a hard-rock area in most places and groundwater is scarce. The depth to the water table varies from two to 60 metres. Drilling a well is a hit and miss affair. In Telangana and Andhra Pradesh (AP), a decades-old programme covering 30,000 people in 638 (Blair and Shah, 2011) villages of seven districts has just wound up. One of the largest of its kind, the Andhra Pradesh Farmer Management Groundwater System (APFAMGS) started as a well-recharge programme but metamorphosed into a larger groundwater management programme of the Food and Agriculture Organization of the United Nations (FAO).

Demystifying Groundwater

The idea, explains Ch. Ram Babu, director of Grama Vikas Sanstha, an NGO that worked on the project in Chittoor District, was to explain to farmers how to measure and manage groundwater. The first step was to make them understand that it is a finite resource. This has been the main source of water in this arid zone. Using simple methods – a well inventory, measuring the depth to the water table, measuring draw-down rates, rain gauges, maximum-minimum thermometers, wind gauges, evaporation gauges and sun recorders – farmers have been taught to prepare water budgets for micro-watersheds, called hydrological units (HU) that stretch from one ridge to the next (FAO, 2008). Local farmers, such as D Lakshmi Devi who reads the rain gauge at the Diguvetigadda Wago HU, take and maintain readings.

Alongside the technical aspects, the project set up village institutions for managing groundwater, conflict resolution and collective bargaining called groundwater user associations. Each has office bearers and members. They meet once a month to discuss the water situation and changes needed in cropping patterns. Before the Rabi season starts, they prepare a chart with details of the crops grown in the HU: acreage, expenditure on cultivation, yield, market prices, income, water use per acre of crop and net income per cubic metre of water.

More crops, better-off farmers

The project's metrics of success go beyond measuring groundwater availability. It has had a major impact on the quality of farmers' lives (Mani and Reddy, 2015). Against nine crops earlier, they now grow 25. Nearly all use drip irrigation. Incomes have gone up, the brick and mortar houses being evidence, while migration has dropped, the presence of youth and men being evidence. Farmers and their families clearly understand groundwater is not limitless.

What APFAMGS and similar projects debunk is the urban water practitioners' notion that farmers cannot understand what groundwater is, that it is finite and how to manage it. Not only have they understood it very well, they have befriended it and used it to their advantage. The impact of APFAMGS is not just intelligent use of this resource but the changes in the social milieu of villages that practise it.

The AP government recently expanded the concept of participatory groundwater management. It has started a programme for integrating these institutions with panchayats in AP that will take it forward. Institutionalisation is a welcome next step but will need political and financial commitment.

IV. OLD DESIGNS IN NEW LIGHT

In the extremely dry western belt of Rajasthan, it rains less than 20 cm a year. Groundwater is scarce and salty, not just brackish. Temperatures in the desert are in the 40s (Centigrade) through summer. The few centimetres of rain are all people have to cling to for their life and livelihoods. Here, a clear separation of water for different purposes and ingenuity sees them through.

Tankas have existed for centuries as the main means of storing rainwater. The old ones were circular pits about 15 feet deep and as many across, covered with thorny bushes and surrounded by a sloping circular catchment of beaten earth and gravel. The pits were lined with a mixture of lime and sand. Collection efficiencies were less than 20 per cent but filled up during a normal monsoon.

About 15 years ago the Jal Bhagirathi Foundation (JBF), an NGO, started work in the Champabari Village of Barmer District. They improved on an old design – the pit was made of bricks and mortar and enlarged while the catchment was expanded and covered with a layer of cement. Pits were covered with cement slabs and occasionally provided with a small handpump to make it easier to take out water, instead of a bucket. Collection efficiencies are about 70-80 per cent, pits are larger and fill faster. As tankas are fully covered, evaporation losses are minimised.

Along with these improvements, JBF set up institutions to manage local water resources. While most tankas are private there are a few community tankas and other water collection structures such as talaabs (artificial ponds). There is a jal sabha [water assembly] in each village comprising the heads of households. The average size is 30 people and they elect five office bearers.

Securing drinking water

One such is Sona Ramji, the secretary of the Champabari Jal Sabha. His tanka holds enough water for his family to drink through the year provided the rains are normal. An older tanka also has water for animals. Both are situated a short walk from his house and surrounded by a barbed wire fence. The new tanka cost him about Rs 50,000 of which the NGO provided 60 per cent.

A variant of this circular catchment tanka is a rooftop-connected tanka. Useful in more densely populated settlements, rainwater from rooftops is channelled into the tanka. The tanka in this case is made indoors under the courtyard or wherever possible. In addition to tankas, JBF has restored

more than 400 ponds in the region. Rainwater stored and shepherded sees these people through the harsh summers.

In contrast, overhead water towers stand forlornly in the desert waiting for water from a distant source. The State government has over the past years repeatedly launched many multi-village piped water schemes, none of which has been completed for want of water. This year, the State government announced a large rainwater-based water conservation programme. This has elements of initiatives such as JBF's but the crucial component will be building social structures to support the physical infrastructure.

Challenges

In all these schemes, social capital has been the hardest and longest investment. Without the social structures to make and manage these resources no water conservation can work. Government largesse actually militates against social capital creation as it fosters dependence on the unreliable 'welfare' state.

Water is susceptible to bacterial contamination and this needs to be tackled urgently otherwise it will undermine any water conservation work. India's poor hygiene and sanitation record is the single biggest source of this contamination. Some easy means of preventing contamination are, to ensure: there are no toilet upstream of the water facility, toilets are made at least 10 m from the water facility, the first rainfall water is not channelled into the well or tanka, the sand filters are cleaned before the rains start and the drinking water sources are kept covered with nylon or wire mesh.

For community mobilisation, distributing literature and public meetings have proved effective in Thrissur, Telangana and Rajasthan. These need to supplement the hardware activities. In addition to creating demand, public information needs to encompass safe storage and handling of water, disinfection at point of use and other hygiene behaviour. Traditionally water has been boiled before drinking; alternative methods for sterilising water need to be reinforced.

Maintenance is simple but the poor may need financial assistance. In Kerala the Kudumbashree provides a channel for this assistance. To reduce maintenance, unplasticised Polyvinyl Chloride (UPVC) that is resistant to the ultraviolet radiation from the sun, should be used universally. Better quality fixtures and plumbing can lower maintenance needs and costs. More trained plumbers will be needed to make the systems. In Rajasthan households repair their tankas. In Telangana, farmer groups manage water harvesting structures and water distribution.

V. LESSONS FOR POLICY MAKING

Different approaches are needed and one size does not fit all rainwater harvesting techniques. In Rajasthan, scarce rain is stored in underground tankas that minimise evaporation losses. It is insulated from the saline groundwater. In Kerala, abundant rain is stored in wells and aquifers owing to the porosity of the soil. In Andhra Pradesh, groundwater intelligence has helped shepherd rain water by developing the expertise of farmers.

All three models discussed in this Issue Brief have shown they can be scaled up rapidly. The government's role is to provide funds (loans), a local NGO can develop the social capital and industry can optimise the hardware. The principle of harvesting rainwater makes this model usable anywhere there is rain, ponds and wells. In villages where are no ponds or wells, handpumps and tubewells can be used instead. Nearly all villages have ponds that can be open air water storages. Rainwater is distributed, as is water use. Bringing rainwater harvesting into the equation helps to balance supply with need in the most cost-effective manner possible. The unit capital and maintenance costs are low, technology is simple and usable by people anywhere.

Decentralised community-led rainwater systems must form part of all major government water and watershed programmes. It must be included in NRDWP, MGNREGS, and similar schemes. What has worked is the programme being handled by the local self-government department (panchayati raj department in other States) rather than by the Public Health Engineering Department or the Central Groundwater Board. This is based on the appreciation that such a programme needs popular support more than technical solutions. In other States or at the national level, this will be an important consideration when deciding where to place the programme.

Financial support is a must but not as a subsidy or grant; rather it must be given to the poor as a loan as people are more than willing to invest in their own water security. People want to contribute physical labour or funds for symbolic capital. This loan can be routed through Self Help Groups rather than government channels. A strong communication strategy is essential to promote this as a safe source of drinking water, backed by water storage, handling and purification education.

In Rajasthan, the State government has launched a Jal Samvidhan Programme to restore local water resources such as johads, talaabs and tankas. More than the technical parts, institutions are vital for managing these resources as is evident from the work of JBF. Rather than an engineering-driven approach of mega schemes, small household level schemes will work in a State like

Rajasthan where households and habitations are scattered. Piped water will be expensive to supply and prone to frequent breakdowns; wastage is also much higher from these projects.

Social structures are as important as the physical ones. In the absence of the first, the second has limited utility and falls apart quickly. While it takes several years, some estimates go up to 10 years, for creating viable social structures, this is time and money well spent to ensure the physical infrastructure is used, maintained and lasts. Once set in motion, social change also takes care of the future needs of the community i.e., people become competent to plan, build and maintain physical infrastructure to take care of their current and future needs.

The problem here is government programmes run on annual cycles and do not take community empowerment seriously; they are aimed at creating physical infrastructure that is measurable and tangible within that time frame. People's agency, where people invest in local water structures regardless of their ability to pay to secure their immediate rights to the resource, takes time to develop. In other words, people are willing to put in time, effort and money to create or rehabilitate water resources as they feel this will guarantee them access in the future.

Effective planning and execution need to happen at different levels. Districts are usually the units of planning and allocation of funds. Gram panchayats are usually the units of implementation. Watersheds may not correspond to these administrative divisions. APFAMGS has showed how the two can be brought together physically and institutionally. Thus, different solutions based on local planning aim at augmenting and optimising local water use. Each has a variant of the community-led rainwater harvesting paradigm that is the shortest, most probable route to water security.

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