Case for GRIPP site on Groundwater-based Natural Infrastructure

Managing aquifer recharge and sustaining groundwater use through village-level interventions in India

Supporting villagers in informed and participatory decision making around groundwater use and storage

MARVI – What is it?

The Managing Aquifer Recharge and Sustaining Groundwater Use through Village-level Intervention (MARVI) project has developed a village-level participatory approach for measuring groundwater levels and improving water-use efficiency in groundwater-stressed regions of India [1]. Farmers and other stakeholders are directly involved in the process. A unique feature of MARVI is the engagement of *Bhujal Jankaars* (BJs) [2], a Hindi word meaning "groundwater informed". These are volunteers who, with appropriate training and capacity building by the project team, monitor rainfall, groundwater levels and quality, and water levels of managed aquifer recharge infiltration basins (called check dams). They also make sense of the data from a village perspective and infer what can be done to improve the groundwater situation and household livelihoods, which are often based on growing crops with groundwater irrigation. Importantly, the BJs inform and guide villagers on the groundwater situation and how best to use groundwater in response to seasonal or long-term variability in resources.

Piloting activities

The MARVI project focused on two watersheds: the Dharta watershed in Rajasthan and the Meghraj watershed in Gujarat, India. In total, 11 villages were involved. Both watersheds have hard rock aquifers implying that they are relatively shallow and produce less water, and the groundwater resources are fragile in terms of depletion and degradation. In many parts of India, including the watersheds targeted in this study, groundwater tables have been declining in recent times. The management of groundwater has become quite complex due to a range of actors involved in its development and use (Figure 1). The main activities in the MARVI project included the design and implementation of participatory processes to assist village-level discovery and application of solutions for sustained groundwater use and improved livelihoods. The solutions explored included creating awareness about the extent of the problem; building local capacity to monitor, quantify and manage groundwater resources; and piloting village groundwater cooperatives. Overall, the activities focused on improving cooperative decisions about sustainable groundwater use at the village level.

Figure 1. One of the BJs measuring groundwater levels manually (photo: B. Maheshwari).

Water table fluctuations in 250 dug wells in the Dharta watershed and 110 in the Meghraj watershed were monitored over 5 years by BJs using a simple 50-m measuring tape and a wooden circular float (15 cm in diameter) on a weekly basis (Figure 2). BJs also monitored rainfall and water levels in a number of check dams[3]. The monitoring helped to understand the recharge performance of local check dams and their effects on groundwater availability in nearby wells. Thus, the monitoring by BJs enabled the establishment of a comprehensive database, which was shared using the MyWell app (available on Android and iOS platforms) and used by village communities and other stakeholders to understand the groundwater situation and explore options for sharing these resources. This app particularly helps in crowdsourcing groundwater measurements over short message service (SMS) or Android phones. The app enables anyone across India to participate in monitoring the water table, rainfall and check dam water levels, information that is shared publicly on the web.

The transformation of local villagers into local groundwater champions (i.e., BJs) required efforts to build not only their technical capacity but also their confidence in what they can achieve for their villages (Figure 3). The incentives for the BJs to continue in the MARVI project were not just some token offering financial rewards (INR 1,000 per month, which is about USD 40 per month) but also their pride in being groundwater-informed and gaining respect within their communities on groundwater matters.

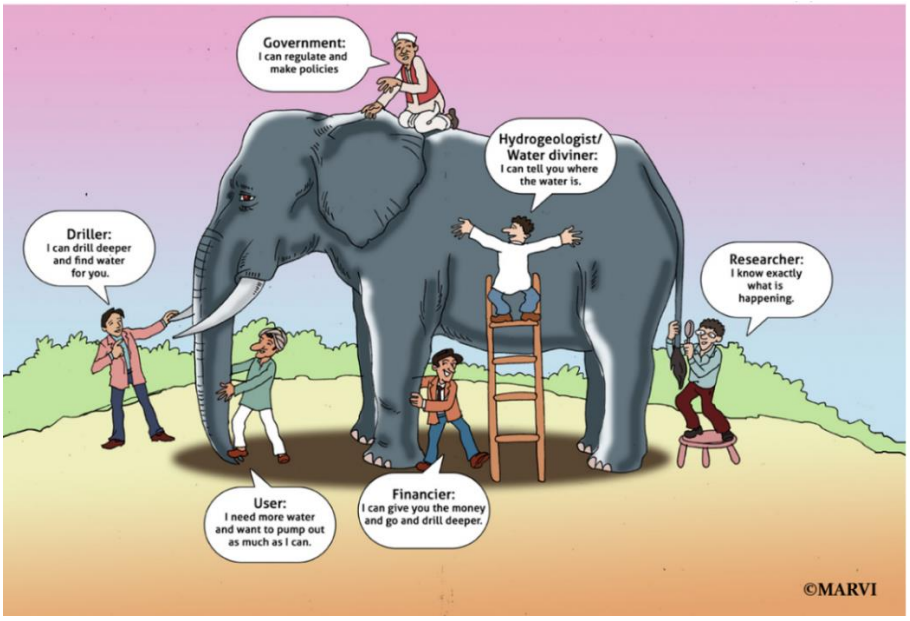

Figure 2. The complexity of the "groundwater elephant" (source: MARVI).

Figure 3. One of the dug sites used to monitor groundwater level with an automatic sensor (photo: B. Maheshwari).

Linked to this work, capacity-building activities advanced the groundwater knowledge of farmers, local communities, schools and decision makers (Figure 4). A number of tools, protocols and approaches were developed to assist in collecting and analyzing biophysical and socioeconomic data to understand annual groundwater recharge, water availability for irrigation, crop water

demand, cropping area and socioeconomic parameters that impact the sustainability of groundwater use and interventions [4] [5].

Findings and early experience from the pilot

An approach for community-based, participatory groundwater monitoring and management has been developed through close collaboration between research and development agencies and village communities. Data monitored by BJs and water level sensors have enabled the validated estimation of local hydrogeological parameters, and the development of simple groundwater balances for each village and surrounding landscape [6] (Figure 5). The SMS system and MyWell app developed during the project have facilitated the collection, sharing and analysis of village water data.

Figure 4. Classroom training workshop for BJs (photo: Y. Jadeja).

BJs, 36 of them in total, are proving to be significant change agents through their high-quality measurements, understanding of the groundwater situation and communication with communities in the two watersheds. They are also an important interface between researchers and the communities. As a result of the effective engagement of village communities and as evidenced by local data collected over the last 5 years, farmers better understand their local groundwater system, realize that the resource is limited and accept that the falling water table is a village-level issue that needs to be tackled at that level. The process takes time, continuous efforts by the BJs and tracking of successful measures put in place.

One of the important achievements of the MARVI approach is the farmer-established village groundwater cooperatives (VGCs), three of which were formed in the Dharta watershed and two in the Meghraj watershed. Each VGC consists of 14 to 20 farmers and represents an agricultural land area of 18 to 40 ha. The groundwater in some of these VGCs was traditionally shared through a barter system, in which a farmer who provided groundwater to neighbors through access to a

private well received one-third of the produce from the land in exchange for the water provided. Farmers who formed VGCs felt that this barter system was not fair, created equity issues and did not support groundwater sustainability. The VGC aimed to raise these issues and discuss a more equitable way to access groundwater, based on the tools developed under the MARVI project. For instance, the groundwater level data revealed that deepening wells or installing deeper tube wells amounts to snatching groundwater from others, and provides no extra water overall. As a result, the farmers have already taken measures to stop drilling deeper, remove sediment from the recharge structure (to enhance recharge), determine maximum possible *Rabi* (winter) crop areas from post-monsoon groundwater levels, improve soil mulching and water-use efficiency, and diversify crop types depending on water availability. Some of these solutions are being supported by a follow-up MARVI project in the study villages and beyond.

Figure 5. Engaging with future groundwater managers in villages (i.e., children) is important (photo: J. Ward).

Overall, the experience of the MARVI project indicates that a transdisciplinary and participatory approach is effective in enabling farmers, other community members and nongovernmental organizations to work together with researchers and government agencies to understand the groundwater situation and design interventions that are holistic and gain wide ownership at the village and *Gram Panchayat* (i.e., Village Council) levels. Such an approach is expected to achieve long-term groundwater sustainability at a regional or basin scale, although with prolonged and substantial external support.

What's next?

The MARVI approach developed has been tested in two watersheds in Rajasthan and Gujarat over 5 years and is now ready for upscaling to other areas in these two states and beyond, as well as for further testing of VGCs as a means to achieve sustainable groundwater recharge and use.

Future investments are required by the central and state governments, and Corporate Social Responsibility (CSR) funds to refine and adapt the approach to conditions in other parts of India.

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