IWMI- TATA
Water Policy Program

15

Water Policy Research

Highlight

Private Initiative for Groundwater Recharge:

Case of Dudhada Village in Saurashtra

R. Sakthivadivel
R.K. Nagar

In Dudhada, a 42 km long artificial canal was built for recharging groundwater by villagers with support and inspiration from diamond merchants. The approach is being replicated in about 400 villages of Bhavnagar and Amreli districts under the popular recharge movement: '*Saurashtra Jal Kranti*'.

The study shows that large investments and full-scale participation do not guarantee desired results unless the recharge structures built on the surface are linked to the aquifer with natural fractures that permit quicker recharge. Also, considerable savings in investments are possible if water harvesting structures are planned after a thorough study of the rainfall pattern.

Private Initiative for Water Recharge: Case of Dudhada Village in Saurashtra[1]

RESEARCH HIGHLIGHT BASED ON A PAPER TITLED:

"RESPONSE TO PRIVATE INITIATIVE FOR WATER RECHARGE: CASE OF DUDHADA VILLAGE, AMRELI DISTRICT"

INTRODUCTION

While studying the overall progression of the recharge movement that started almost simultaneously all over Saurastra in the 1990s, we found three types of initiatives to be largely responsible for the movement to assume the present dominant status of water recharge. First, a totally individual initiative later supported by spiritual organizations which used direct well recharge as the main method of recharge. An example of this type can be found in villages such as Kadavanthali where the spiritual movement is intense. Second, an initiative by the local village leadership that succeeded in using government funding for various developmental projects over time to build water harvesting infrastructure to create a long term impact in sustaining agriculture and livelihoods. Building percolation tanks and check dams on rivers and rivulets that pass through the village as in Raj Samadhiyala is an example of this type. Third, individual initiative supported by a large private investment in water harvesting taking village as a unit and involving the village community to directly participate in the venture.

Three types of initiatives have helped in spreading the '*Saurashtra Jal Kranti*' the popular recharge movement in Saurashtra:

- **Individual initiative based on well recharge, supported by spiritual organisations**
- **Community initiative supported by government funds**
- **Individual Initiative supported by large private investment by diamond merchants**

The third initiative is by diamond merchants who formed a trust called Saurashtra Jaldhara Trust and started work in Khopada village in Bhavnagar district. This approach has been followed on a much larger scale in two districts of Bhavnagar and Amreli, from where a large number of young men are engaged in diamond and related trades. Entrepreneurs hailing from these districts and based in Surat city in south Gujarat took the initiative to mobilize the masses, invested their own funds, manpower, and time, and created an institutional structure. In Dudhada, the entire infrastructure an artificial canal cum drainage network measuring 42 km in length with 65 check structures/causeways spaced at 500 meters from each other within the canal was built in just eight months.

The seed capital contributed by a diamond merchant, Govindbhai from the village, following the success of a similar initiative in 1998 in Khopada village, gave a strong momentum to the process of rain water harvesting and recharge. The essential difference in the approach followed in Dudhada is that the flat village topography is unsuited for the Raj Samadhiyala type of infrastructure building and, therefore, the promoters adopted a massive canal network structure as one way of overcoming the topographical disadvantages.

---

[1]The research covered by this IWMI-Tata Research Highlight was carried out with generous support from Sir Ratan Tata Trust, Mumbai under IWMI-Tata Water Policy Programme. The research paper can be downloaded from the IWMI-Tata Website http://www.iwmi.org/iwmi-tata.

Ensuring Participation

In order to ensure participation of villagers, the diamond merchants use the employer-employee relationship as a basic motivating factor. Since it is mainly the young men from their own villages they employ in diamond cutting units, it is easier for them to invite them to a meeting, explain to them the need for water harvesting in the village and seek their voluntary participation in the initiative. All employees then naturally volunteer to contribute a certain amount decided in the meeting that is uniform for all employees.

Employees are also requested to join their employers and other volunteers from the village in organizing a meeting of the village community. Since the contribution from the villagers is expected in form of land to create the canal cum cart track network, it becomes the responsibility of individual employees to convince their kin to agree to the proposal. According to SJT sources, this approach has helped in quick decision- making and therefore speedy implementation of the project.

The logic behind the initiative is simple. Since the village topography is flat and there are no natural water courses and water bodies to capture the monsoon runoff, creation of a drainage canal network around the village will serve as a water body with large enough capacity to hold the monsoon runoff and ensure recharge of all the village wells. The network was built by converting the existing cart track(s) into canals. Farmers owning land adjacent to the cart-track voluntarily contributed a 15 feet wide strip of their land free of cost to build the canal network and a new elevated cart track.

Currently the approach is being replicated in about 400 villages of Bhavnagar and Amreli districts with seed capital for the work coming from the Saurastra Jaldhara Trust. This is now the lead organization in water recharge movement coordinating the activities of all other smaller organizations initiated by diamond merchants in their respective villages and *talukas*. The large-scale replication has taken off without the efficacy of this method being scientifically established. The institutional and equity issues are also unexplored.

Under the IWMI-Tata program, we carried out a study for scientific assessment of the technical and institutional aspects of the Dudhada model. The objectives of were:

1. To estimate the actual extent of total and augmented recharge caused by the drainage canal network
2. To investigate whether the benefits of the initiative reach all farmers in the village
3. To study the institutional structure and its strengths, especially local participation
4. To assess whether the experiment is worth replication on a large scale, especially since the efficacy of the recharge is yet to be established and
5. To identify the possible long term impacts of up-scaling the initiative to nearly 400 villages.

We conducted a baseline survey of all dug well owners in the village to select a uniformly spread sample of 30 dug wells for recording daily changes in water levels. The data were collected for a period of seven months beginning from the onset of monsoon (mid June) to the end of the cotton season (first week of January). Daily rainfall was also recorded in the village to establish a link between rainfall, natural recharge, and augmented recharge due to water harvesting structures. In addition, irrigation and crop output data were collected for all principal crops to determine the irrigation-output relationship. A socio-economic survey covering 36 households was carried out to get an insight into the recharge movement from the village community's perspective.

Some Results

The drainage network in Dudhada augmented natural recharge from 0.55 MCM to 1.05 MCM an increase by almost 90 percent. However, the recharge had an iniquitous impact among land holders. Those who do not own wells do not benefit from recharging and among farmers who owned wells, those with deep dug wells and bore wells benefited more than others.

Long term rainfall analysis indicates that during the last 7-8 years, there has been a decline in rainfall (Figure 1). Generally the rainfall occurs in three-four spells. This year it occurred in four spells. At the end of the monsoon (30 September), the average depth of water in the sampled wells was about 29 percent of the well depth. However, there were large variations. Of the thirty sample wells, four wells (40-50 ft deep) did not get recharged at all; another five had less than 10 percent depth of water. Only three wells had more than 38 percent depth of water (Figure 2). Only high intensity rainfall caused recharge through the drainage network.

Figure 1: Annual Rainfall at Lathi, 1960-90 (26 Years)

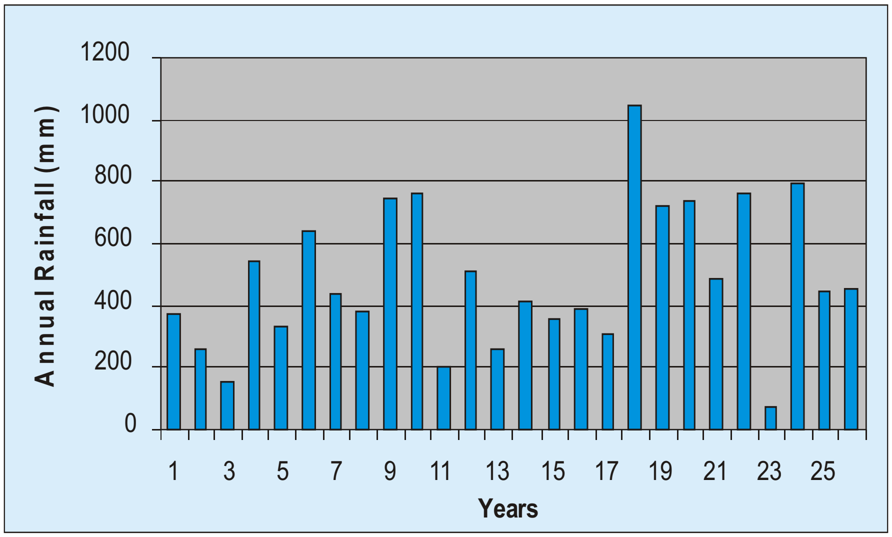
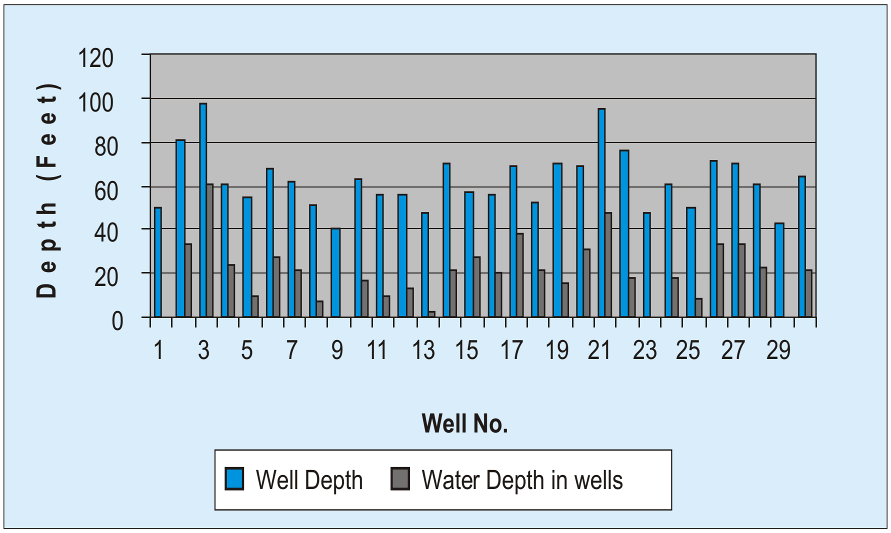


Figure 2: Well Depth vs. Water Level on 30th September



Based on sample farmers' pumping, it is estimated that the amount of recharge directly from the irrigated- and non-irrigated fields is 0.55 MCM while the recharge from the drainage network, computed from the runoff as 0.5 MCM, totalling to1.05 MCM. Of the total recharge, 50 percent is abstracted by 29 tube wells while the remaining recharge is shared by 62 dug wells. Even among dug wells, only those wells with greater depth (75 to 100 ft) were able to pump more water. Overall, this method of recharge is able to put roughly 20 percent of total volume of rainfall of 4.6 MCM into groundwater formations.

The Dudhada Jal Vikas Samiti (DJVS) claimed in an interview with us that, in 2000, the canal network filled up twice providing enough water to recharge the wells. The total produce harvested in the village was 1000 MT of cotton and 200 MT of wheat, which would not have been possible without the recharge contributed by the network. In 2000, cotton commanded an average price of Rs. 22.50 per kg and wheat though grown exclusively for home consumption, at Rs. 11 per kg. The gross value of these two crops alone works out to Rs. 24.70 million. In a drought situation of 2000, without recharge, the value of cotton output would have fallen to an estimated 4.5 million and there would have been no wheat. Thus the total additional output contributed by these two irrigated crops is approximately Rs. 20 million or 88 percent of the investment; hence this approach of water harvesting makes it very attractive for quick returns. This has been one of the major drivers to spread the approach on a large a scale.

Our observations made in the normal monsoon year of 2001, however, raised many questions about the efficacy of the method. If the benefits in a drought year could be as great as claimed by DJVS, in a normal year like 2001, why there was not enough water to irrigate larger areas? Why is it that the water level at the end of December had declined to such a low level and why is it that the wells of 50 feet depth or less did not have any water at all?

Does it mean that the aquifer is already depleted to a greater depth and the benefit that should have gone to dug well owners has been usurped by bore well owners who have not abided by the resolution to plug all the bores? Or is it that water harvesting structures are getting connected to fractures that take away water from the dug wells to lower depths of aquifer? Many of these questions require detailed scientific study.

This study does bring out clearly that large investment and full-scale participation do not guarantee desired results unless structures built on the surface are linked to the aquifer with such natural fractures that permit quicker recharge. Moreover, considerable savings in investments are possible if water harvesting structures are planned after a thorough study of the rainfall pattern. The rainfall pattern has a very important bearing on the planning for water harvesting structures and on downstream impact of the capacity created. Understanding the hydrogeology and hydrology of the area is very important in planning water harvesting structures which can efficiently use the harvested water for underground recharge rather than allow it to evaporate. Another aspect is the equity in use of recharged water. Those farmers who did not own wells did not benefit by recharging and among farmers who owned wells, those with deep dug wells and bore wells benefited more than others.

Large investments and full-scale participation do not guarantee desired results unless structures built on the surface are linked to the aquifer with such natural fractures that permit quicker recharge.

IWMI-Tata Water Policy Program

The IWMI-Tata Water Policy Program was launched in 2000 with the support of Sir Ratan Tata Trust, Mumbai. The program presents new perspectives and practical solutions derived from the wealth of research done in India on water resource management. Its objective is to help policy makers at the central, state and local levels address their water challenges – in areas such as sustainable groundwater management, water scarcity, and rural poverty – by translating research findings into practical policy recommendations.

Through this program, IWMI collaborates with a range of partners across India to identify, analyse and document relevant water-management approaches and current practices. These practices are assessed and synthesised for maximum policy impact in the series on Water Policy Research Highlights and IWMI-Tata Comments.

The policy program's website promotes the exchange of knowledge on water-resources management, within the research community and between researchers and policy makers in India.

IWMI-Tata WATER POLICY PROGRAM
Elecon, Anand-Sojitra Road
Vallabh Vidyanagar, 388120, Gujarat, India
Telephone: 91-2692-229311-12-13
Fax : 91-2692-229310
E-mail: iwmi-tata@cgiar.org
Website: http://www.iwmi.org/iwmi-tata

International Water Management Institute

FUTURE HARVEST
IWMI is a Futures Harvest Center
Supported by the CGIAR

HEADQUARTERS
127 Sunil Mawatha, Pelawatte, Battaramulla, Sri Lanka
Mailing Address : P. O. Box 2075,Colombo,Sri Lanka
Telephone : +94 1 787404,784080 ; Fax : +94 1 786854
E mail : iwmi@cgiar.org

REGIONAL OFFICE FOR ASIA
(Bangladesh, China, Nepal and Sri Lanka)
127 Sunil Mawatha, Pelawatte, Battaramulla, Sri Lanka
Mailing Address : P. O. Box 2075,Colombo, Sri Lanka
Telephone : +94 1 787404,784080,1 ; Fax : +94 1 786854
E mail : iwmi-asia@cgiar.org

CHINA
Center for Chinese Agricultural Policy,
Chinese Academy of Sciences
Building 917,Datun Road, Anwai, Beijing,100 101, China
Telephone : +86 -10 64889440,64856535,64856837
Fax : +86 -10 64856533
E mail : j.wang@cgiar.org

NEPAL
GPO 8975 EPC 416, Kathmandu, Nepal
Telephone : +977-1 535382 (Ext. 486)
Mobile Tel : 9810 - 22573 ; Fax : +977-1 523996
E Mail : d.pant@cgiar.org

REGIONAL OFFICE FOR AFRICA
141, Cresswell Street, 0184 Silverton, Pretoria, South Africa
Mailing Address: Private Bag X813,Silverton 0127, South Africa
Telephone : +27-12 - 845 9100 ; Fax : +27-12 - 845 -9110
E Mail : iwmi-africa@cgiar.org

KENYA
C/o. ICRAF, United Nations Avenue, P. O. Box 30677, Nairobi, Kenya
Telephone : +254 - 2 - 524751,524000 ; Fax : + 254 -2 - 524001
E Mail : f.gichuki@cgiar.org

GHANA
IWMI Ghana,CSIR campus,Odei Block,
Airport Res. Area, Accra
IWMI Ghana, PMB CT 112, Cantoments, Accra, Ghana
Telehone : +233-(0) 21-784752/53/54 ; Fax : +233-(0) 21-784752
E mail : iwmi-ghana@cgiar.org

REGIONAL OFFICE FOR INDIA
C/o. ICRISAT, Patancheru, AP 502 324, India
Telephone : +91-40 -329-6161 ; Fax : +91-40 - 324-1239
E mail : iwmi-india@cgiar.org

REGIONAL OFFICE FOR PAKISTAN, CENTRAL ASIA AND MIDDLE EAST
12KM Multan Road, Chowk Thokar Niaz Baig,
Lahore 53700,Pakistan
Telephone : +92 - 42 - 5410050-53(4 lines) ; Fax : +92-42-5410054
E mail : iwmi-pak@cgiar.org

UZBEKISTAN
Apartment NO.103,Home No.6,Murtazaeva Street,
Tashkent 700000, Uzbekistan
Telephone : +998 - 71-1370445 ; Fax : +998 -71-1370317
E mail : v.hornikova@cgiar.org

REGIONAL OFFICE FOR SOUTHEAST ASIA
(Cambodia, Indonesia, Laos, Malaysia, Myanmar, Philippines,Thailand,Vietnam)
P. O. Box 1025, Kasetsart University Jatujak,
Bangkok 10903,Thailand
Telephone : +66 2 561- 4433 ; Fax : +66 2 561-1230
E mail : iwmi-sea@cgiar.org