Environment

Water Community

Solution Exchange for the Water Community
Consolidated Reply

Query: Reviving Traditional Rainwater Harvesting methods for Climate Change Mitigation - Advice, Examples

Compiled by Nitya Jacob, Resource Person and Sunetra Lala, Research Associate
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From Niranjan Singh, Shekhawati Jal Biradari, Jhunjhunu (Rajasthan)

Posted 18 March 2011

I work with the Samajik Vikas Sansthan, an organization promoting the revival of traditional rainwater harvesting (RWH) methods in this arid part of Rajasthan. We work in several villages in the Shekhawati area to promote the restoration of existing ponds and underground water storage structures as well as the construction of new ones. These are vital to the life of people since groundwater is scarce and whatever is available is extremely saline.

The people depend on rainwater for drinking needs. The traditional structures collected and stored this underground in quantities large enough for meeting the need of families for the entire inter-monsoonal season. These structures, called tankas, slowly fell into disuse because of the introduction of piped water schemes and handpumps. However, these newer measures have proven to be unreliable and there is a renewed interest in tankas.

We feel RWH is the most suitable way to help communities in this dry part of the community adapt to climate change, since this phenomenon has made rainfall even more erratic. However, we need to systematically document our approach and that of others, synthesise guidelines and then propose this approach for large-scale use.

To this end, I request community members to provide the following information

1. What are the local RWH techniques from their parts of the country and for what do people use the collected water?
2. How can these made more efficient, e.g., using GIS for locating RWH structures better, newer materials to increase collection efficiency?
3. What are the considerations to keep in mind when using the water for drinking, watering animals and agriculture?

Your inputs will help us initiate work on guidelines that we will share back with the community for further refinement.

Responses were received, with thanks, from

1. **Suman Apparusu, Consultant, Hyderabad**

2. **Satya Prakash Mehra, Rajputana Society of Natural History, Rajasthan (Response 1) (Response 2)**
3. **A L Khan, Uttar Pradesh Irrigation Department, Lucknow**
4. **N Lakshmi Narayana, Geohouse, Hyderabad**
5. **Ashish Gupta, Organic Farming Association of India, New Delhi (Response 1) (Response 2)**
6. **O P Sharma, Wells for India – India Office, Udaipur**
7. **Bhaskara Rao Gorantla, APMAS, Hyderabad**
8. **Pathak R Kripal, National Horticulture Mission, Ministry of Agriculture, New Delhi (Response 1) (Response 2)**
9. **Jyoti Sharma, FORCE, New Delhi**
10. **Nitya Jacob, United Nations Children's Fund (UNICEF), New Delhi**
11. **A. J. James, ICRA Management Consultancy Services Limited, Noida**
12. **B. L. Kaul, Society for Popularization of Science and Progressive Educational Society, Jammu**
13. **Shrikant Daji Limaye, Ground Water Institute, Pune**
14. **James Baldwin, Water and Sanitation Consultant, Goa**
15. **Manoj Kumar Teotia, CRRID, Chandigarh**
16. **Ajit Seshadri, Vigyan Vijay Foundation, New Delhi (Response 1) (Response 2)**
17. **Rajan Aggarwal, Punjab Agricultural University, Ludhiana (Response 1) (Response 2)**
18. **Neelima Garg, Uttarakhand Jal Sansthan, Dehradun**
19. **Amitava Basu Sarkar, Society for Rural Awareness and Development in Himalayan Area, Dehradun**
20. **Devesh Bhardwaj, Consultant, Jaipur**
21. **Jayant Biswas, District Rural Development Agency, Rajnandgaon**
22. **Chari Appaji, Directorate of Sorghum Research (DSR), Hyderabad**
23. **S. K. Gautam, Religare Enterprises, Delhi**
24. **Irene Stephen, UNDP, New Delhi**
25. **Tapan Saha, Institute of Environmental Studies and Wetland Management, M M Sharma, ICRISAT, Patancheru, Hyderabad, India**
26. **Salahuddin Saiphy, S M Sehgal Foundation, Gurgaon**
27. **Anima Sharma, Independent consultant, New Delhi**
28. **Rakesh. K N, Ashoka Trust for Research in Ecology and the Environment, Bangalore**

Further contributions are welcome!

Summary of Responses

Rainwater harvesting (RWH) is once again being seen as the bulwark against a host of phenomenon – climate variability, water scarcity, groundwater depletion and poor water quality. Till as recently as a couple of centuries ago, various RWH techniques provided most of the water for human and animal use and agriculture, given that the country receives most of its rainfall during the four monsoon months. Communities used RWH to tide over the dry period in between two monsoons. Many of the RWH methods fell into disuse in the 18th and 19th centuries, and

have seen some sort of revival only in the last couple of decades, driven mostly by severe water scarcities.

As people used RWH for their own use, there is a large range of techniques in India to suit different climates, geographies and cultures. In **Rajasthan**, one of the driest states in India, there are separate ways to collect water for drinking and other human uses, watering animals and agriculture. In the Shekhawati region, people build tankas, an underground water tank with a circular catchment, to capture rainwater for drinking. These can hold up to 100,000 litres of water. Johads collect rainwater on the surface for farming and watering animals; they help increase soil moisture and maintain groundwater levels. They also make check-dams across gullies to store run-off water and increase infiltration into the soil, as in the Mount Abu region. Several NGOs have helped promote these techniques and make them more efficient, such as in the Pali, Marwar, Jodhpur, Churu and Barmer districts. The Banjara community, mostly nomads traditionally provided rulers and even invaders with water, for example in the Bharatpur region.

In Himachal Pradesh, people create ponds on or near hilltops to catch rainwater by excavating earth and buttressing the sides with stone. These help recharge wells and streams further down. In Jammu, there are upland areas called Kandi that have hundreds of ancient ponds to store rainwater. Most have fallen into disuse, though. This is a common practice in Goa as well where they are called tollems. People excavate earth from a flat area near a hilltop and line the walls with blocks of lateritic stone.

The Punjab Agriculture University has developed a technique for RWH for groundwater recharge and has set up 40 structures in the state. The Uttarakhand Jal Sansthan has revived 2,200 chals and khals, natural RWH structures, by desilting that has improved water availability. Other RWH ways in the state include diverting rainwater through plastic pipes into cement tanks. If a structure needs recharging, people dig a pond upstream of the source to collected rainwater runoff. In neighbouring **Haryana**, in the Mewat region, an NGO has revived several RWH structures such as baolis, ponds and dug wells through watershed treatment.

Further south, in Bundelkhand, lie thousands of artificial ponds built by the former rulers of the place, known locally as talaabs. These are usually created by building a stone and mud wall across the flow of water. The wall facing the maximum impact of water is covered with stones to reduce erosion while the other walls are made of mud. There are similar ponds in Andhra Pradesh, Karnataka and Tamil Nadu, especially where rainfall is low or erratic; some estimates put their total number at 150,000 across India. In each of these three states, the state government and NGOs have active programmes for reviving ponds. The Asian Development Bank also recognized their importance, and published a study on the rehabilitation and management of tanks in India.

In **Maharashtra**, RWH has helped shore up water availability since roads and housing have reduced the recharge area of wells. In **Gujarat**, checkdams across gullies have dramatically improved the water levels in wells. In West Bengal, an NGO has installed RWH systems in schools for drinking water.

Given this mind boggling diversity of RWH structures, there will be an equally wide range of methods to improve their efficiency so they can help to mitigate the effects of climate change. An NGO in Jaipur has developed a software to simulate the performance of RWH systems with covered tanks that uses a geographical information system (GIS). However, most rural communities will be unable to use or understand the outputs of GIS, and therefore, this will need to be simplified for their use. GIS and remote sensing can help map groundwater resources, terrain and geology to optimize the location of RWH structures. So, for example, it can help

position a pond for groundwater recharge over a pervious zone or another for storing water on the surface over an impervious zone.

GIS can also help to build tanks or ponds in a cascade, that is, an interconnected system in which the overflow of an upstream tank fills the one below. GIS can help identify suitable places with catchments and water channels. It can help design water harvesting systems that serve upstream and downstream needs; a common criticism of RWH is the upstream people reap its benefits while those downstream are deprived of water. However, only technology cannot provide the answer if people have encroached upon the tanks, their channels and catchments. This needs administrative and political will, and a flexible approach as has been done, for example, in Tamil Nadu that has laws mandating RWH. Given the exacerbating effects of climate variability on the weather, revival programmes need to be dovetailed with disaster mitigation and management.

Watershed treatment by afforesting the catchment with local trees and shrubs and improve water availability and reduce soil erosion. For example, in Himachal, planting deodhar pines can promote the natural regeneration of forests. The Indian Agriculture Research Institute has developed a product that saves 40-60 per cent irrigation water. Better waste water management through natural methods can reduce water pollution and its impact on both surface and ground water.

There are different ways to optimize the use of rainwater for different purposes. To increase soil moisture, people in Rajasthan and Bundelkhand store rainwater in their fields for a period. Wells built near a large pond can provide drinking water, a common practice in both old and current times. The end-use of water dictates how it will be used. However, regular quality monitoring is essential for all drinking water sources according to established protocols. Usually rainwater provides the best potable water but its quality still needs to be monitored. In terms of provisioning water, drinking water deserves the highest priority followed by water for livelihoods, water for farming and water for the eco-system. An integrated approach to water management, including RWH, can help mitigate the impacts of climate change.

Comparative Experiences

Gujarat

Farmers revive check dams to increase agricultural productivity, Mandvi *(from James Baldwin, Water and Sanitation Consultant, Goa)*
In Mandvi farmers decided to recharge the check dams and nallahs with rainwater. As a result of this the wells recovered remarkably. This was partly due to excellent design of the recharge wells, effective guidance by an NGO and also the favourable geology of the area. As a result of this initiative farmers in the area could grow crops that was otherwise impossible in the area.

Haryana

Institute of Rural Research and Development (IRRD) builds rainwater harvesting structure in schools to meet drinking water needs , Mewat *(from Salahuddin Saiphy, S M Sehgal Foundation, Gurgaon)*
Mewat is a semi-arid region and receives around 500 mm of rainfall. IRRD created a rainwater harvesting-based drinking water supply in a school in Patkhori village which was solely dependent on erratic and expensive tanker water supply. As a result the drinking water requirements of more than 325 students and teachers are met through rainwater stored in storage tanks which after filtration through bio-sand filters, automatically flows through the taps. Read more.

Maharashtra

Villagers use roof areas to collect rainwater, Amravati District *(from James Baldwin, Water and Sanitation Consultant, Goa)*
In Shendola Khurd village the development of roads and housing had impacted the traditional wells, causing water in the wells to dry up owing to the lack of natural recharge. The villagers here used the roof area of buildings, collected through a system of gutters and pipes, as recharge points for each well. The roads can now be used as channels for run-off collection, with a bit of work on the edges and, of course, the inclusion of properly designed filters.

Rajasthan

Subject, Bharatpur *(from Satya Prakash Mehra, Rajputana Society of Natural History, Rajasthan; response 1)*
In Chak Ramnagar (Banjara village) rainwater harvesting initiatives were taken up by the villagers using their local know-how and use of toposheets/ground level water assessments estimate the water availability. The result of this traditional approach mixed with scientific techniques can be seen in Chak Ramnagar where the new wells have potable water and all other wells in the surrounding areas have saline water.

Subject, Mount Abu *(from Satya Prakash Mehra, Rajputana Society of Natural History, Rajasthan; response 1)*
In the Abu Hills the local communities devised a way to harvest water in the hilly terrain. Although they were not educated they knew the principle of siphons and concept of gradient flow. They used similar techniques and increased the availability of water in their farms. These farmers retain the water on the surface through their age-old practice of water harvesting which meets their irrigation needs.

Traditional rainwater harvesting structures help meet water needs, Shekhawati *(from Nitya Jacob, United Nations Children's Fund (UNICEF), New Delhi)*
Shekhawati is a fairly dry but well-populated part of the Rajasthan desert, with very saline groundwater. The people here have an amazing variety of rainwater harvesting systems. There are tankas for drinking water, talaabs for other domestic use and watering animals and johads for agriculture. The johads are mud and stone wall impoundments and the talaabs are made of stone mortar. These initiatives have helped to meet the water needs of the area. Read more.

Community and individual tanks collect rainwater for drinking purposes, Churu District *(from Devesh Bhardwaj, Consultant, Jaipur)*
In Ratangarh and Sujangarh tehsils, tanks are used at an individual and community level to store rainwater. An artificial catchment is built around a central circular storage tank. The rainwater falling on this artificial catchment is collected in a central storage tank. The water is drawn through pulley and rope arrangement. Before the state government's intervention through water supply schemes, these traditional RWH structures used to be main sources of drinking water.

Related Resources
Recommended Documentation

Rajasthan ki Rajat Boonden-The Radiant Raindrops of Rajasthan (*from Satya Prakash Mehra, Rajputana Society of Natural History, Rajasthan; response 1)*
Book; by Anupam Mishra; Gandhi Peace Foundation; New Delhi;
Available at

http://www.indiawaterportal.org/sites/indiawaterportal.org/files/Radiant%20Raindrops%20of%20Rajasthan_English%20Translation%20by%20Maya%20Jani_0.pdf (PDF; Size: 225KB)

Describes how the ingenuity and patience of people made it possible for life to be maintained in Rajasthan, by applying their technical knowledge to collect rainwater

Direct Negative Impacts of Micro-Hydel Projects on Poor Farmers – A Farmers' Perspective (*from Ashish Gupta, Organic Farming Association of India, New Delhi; response 1*)
Letter; by Ramesh Ganeriwal; Shimla; 2009;
Available at ftp://ftp.solutionexchange.net.in/public/wes/cr/res-18031101.pdf (PDF; Size: 613KB)

Describes the plight of poor farmers who have lost their right to irrigation water as a result of water diversions because of micro hydel projects in Himachal Pradesh

Adapting Water Harvesting to Climate Change (*from O P Sharma, Wells for India – India Office, Udaipur)*
Report; by Jal Bhagirathi Foundation and Wells for India; Rajasthan; February 2010;
Available at ftp://ftp.solutionexchange.net.in/public/wes/cr/res-18031102.rar, (RAR; Size: 2MB)

Highlight the need to revive and adapt the use of traditional water harvesting structures owing to the erratic monsoon and frequent droughts faced by dryland regions

Household Coping/ Survival Strategies in Drought-prone Regions: A Case Study of Anantapur District, Andhra Pradesh, India (*from Bhaskara Rao Gorantla, APMAS, Hyderabad)*
Report; by G. Bhaskara Rao; Society for Promotion of Wastelands Development; New Delhi;
Available at ftp://ftp.solutionexchange.net.in/public/wes/cr/res-18031103.pdf (PDF; Size: 656KB)

Describes household coping strategies which involve rainwater harvesting to meet the water needs in the drought prone areas of Anantapur district

Homa Therapy and its Impact in Mitigating Environment, Soil and Water Crises: A researchable issue (*from Pathak R Kripal, National Horticulture Mission, Ministry of Agriculture, New Delhi; response 1)*
Article; by R.K.Pathak and Ulrich Berk; Manas Rural Development Institute;
Available at ftp://ftp.solutionexchange.net.in/public/wes/cr/res-18031105.pdf (PDF; Size: 166KB)

Describes how indigenous knowledge, including that of rainwater harvesting, can help in mitigating modern day environmental crisis

Mitigating the Potential Unintended Impacts of Water Harvesting (*from A. J. James, ICRA Management Consultancy Services Limited, Noida)*
Article; by Charles Batchelor, Ashok Singh, Ram Mohan Rao and John Butterworth; IWRA International Regional Symposium; New Delhi; November 2002;
Available at ftp://ftp.solutionexchange.net.in/public/wes/cr/res-18031107.pdf (PDF; Size: 200KB)

Recommends that water harvesting should be encouraged but within an integrated or adaptive water resources management framework

Rehabilitation and Management of Tanks in India (*from Irene Stephen, UNDP, New Delhi)*
Case study; by Asian Development Bank; Philippines; 2006;
Available at http://www.adb.org/documents/studies/tanks-india/rehabiliation-management-tanks.pdf (PDF; Size: 250KB)

Documents the reasons for the best performance of tank institutions and the sustainability of rehabilitation carried out by different governments, and NGOs

Rainwater Harvesting and Management in India – A Household Perspective (*from M M Sharma, ICRISAT, Patancheru, Hyderabad, India)*

Document; by MM Sharma, Ch Vengala Reddy and Rosana P Mula; Sharma, Ch Vengala Reddy and Rosana P Mula
ICRISAT; Patancheru;
Available at ftp://ftp.solutionexchange.net.in/public/wes/cr/res-18031108.pdf (PDF; Size: 6.1MB)

Describes why everyhousehold should adopt rainwater harvesting and the household harvesting technique available

Economics of Rainwater Harvesting System
Document;
Available at ftp://ftp.solutionexchange.net.in/public/wes/cr/res-18031109.pdf (PDF; Size; 22KB)

Provides the cost benefit analysis of installing rainwater harvesting structures

Jal Yatra -Exploring India's Traditional Water Management Systems (*from Nitya Jacob, United Nations Children's Fund (UNICEF), New Delhi)*
Book; by. Nitya Jacob; United Nations Children's Fund (UNICEF); Penguin Books India; New Delhi; 2008;
Available at www.jalyatra.com

The book examines traditional structures and systems of water use, including rainwater harvesting structures, some of which have fallen into disuse over the years

From Sunetra Lala, Research Associate

Background: The Water Component of Ecosystem Services and in Human Well-being Development Targets
Report; by Jennie Baron; Stockholm Environment Institute, York, UK/ Stockholm Resilience Centre, Stockholm; in Rainwater Harvesting: A Lifeline for Human Well-being; United Nations Environment Programme/ Stockholm Environment Institute; pp 4-13; 2009.
Available at http://www.unep.org/Themes/Freshwater/PDF/Rainwater_Harvesting_090310b.pdf (PDF; 2.36 MB)

Highlights the link between rainwater harvesting, ecosystems and human well being and draws the attention to both the negative and positive aspects of using this technology.

Rainwater Harvesting in India: Some Critical Issue for Basin Planning and Research
Research Article; by M. Dinesh Kumar, S. Ghosh, A. Patel, O.P. Singh and R. Ravindranath; Journal Land Use and Water Resources Research; Vol. 6, 2006
Available at http://ageconsearch.umn.edu/bitstream/47964/2/paper06-01.pdf (PDF; Size: 993 KB)

Identifies critical issues in rainwater harvesting efforts like lack of data on hydrological regime, water demand, poor integration between surface water & groundwater systems.

Chasing a Mirage: Water Harvesting and Artificial Recharge in Naturally Water-scarce Regions
Research Article; by M. Dinesh Kumar, A. Patel, R. Ravindranath and O.P. Singh; Economic and Political Weekly; Vol. 43, No. 35; Aug-Sep 2008.
Available at http://www.epw.in/epw/uploads/articles/12606.pdf (PDF; Size: 413 KB)

Shows that in water-scarce regions of India, run-off harvesting does not offer any potential for groundwater recharge or improving water supplies at the basin scale.

Upstream vs Downstream: Groundwater Management and Rainwater Harvesting
Research Article; by S. Ray and M. Bijarnia; Economic & Political Weekly; Vol. 41, No. 23; June 2006.
Available at http://www.epw.in/epw/uploads/articles/2193.pdf (PDF; Size: 133 KB)

Analyses status of groundwater availability in three villages of Alwar district in Rajasthan where a large number of communities have constructed rainwater harvesting structures.

Ralegaon Sidhi
Article; Wikipedia; 7 August 2008
Available at http://en.wikipedia.org/wiki/Ralegaon_Siddhi
Describes how the village of Ralegaon Sidhi, Maharashtra has set an example for water harvesting, watershed management and overall rural development

Hiware Bazaar: Community Stewardship of Water Resources
Article; by Nikhil Anand; India Water Portal; Maharashtra; July 2007
Available at http://www.indiawaterportal.org/tt/wbr/case/seed_watr.pdf (PDF, Size: 344 KB)
Describes how community imposed regulations lead to groundwater conservation and water harvesting, which helped to mitigate water shortages

Recommended Contacts and Experts

Mr. Anupam Mishra, Gandhi Peace Foundation, New Delhi *(from Satya Prakash Mehra, Rajputana Society of Natural History, Rajasthan; response 1)*
221/223 Deen Dayal Upadhyaya Marg, New Delhi-110002; Tel: 91-11-23237491/ 23237493; http://www.gpfindia.org; http://www.indiawaterportal.org/node/7354
Works on environment and water conservation; has documented the community led traditional water harvesting in Rajasthan; does not hold any copyright over his writings.

Recommended Organizations and Programmes

From Suman Apparusu, Consultant, Hyderabad

Jal Bhagirathi Foundation, Rajasthan
D-66 (B), Sawai Madho Singh Road, Jaipur 302016, Rajasthan; Tel: 91-141-2280964; Fax: 91-141-4025119; jal@jalbhagirathi.org; www.jalbhagirathi.org/
Works, through community participation, in the arid areas of Rajasthan to revive traditional rainwater harvesting structures

Ajit Foundation, Rajasthan
396 Vasundhara Colony, Tonk Road, Jaipur 302019, Rajasthan; Tel: 91-151-2528483; Fax: 91-141-2709938; vsvyas@mac.com; http://www.ajitfoundation.org/
A voluntary organisation working in Bikaner, has revived rainwater harvesting structures across several areas of Rajasthan

Pan Himalayan Grassroots Development Foundation, Uttarakhand*(from Ashish Gupta, Organic Farming Association of India, New Delhi; response 1)*
Post Bag # 3, Ranikhet 263645, Almora District, Uttarakhand; Tel: 91-5966-221516; Fax: Fax No. apaul@grassrootsindia.com; http://www.grassrootsindia.com/water.html
Provides grant assistance to communities for drinking water and sanitation projects, including those for rainwater harvesting

From O P Sharma, Wells for India, Udaipur

Wells for India, Rajasthan
1135, Sector No. 4, Hiran Magri, Udaipur 313002, Rajasthan; Tel: 91-294-2464617/2464618; wellsforindia@gmail.com; http://www.wellsforindia.org/; Contact Om Prakash Sharma; Director India Office; Tel: 91-294-2481182

A UK charity working on water related projects in Rajasthan with a focus on provision of sufficient clean water for drinking, cooking, washing, the animals and for irrigation

Gramin Vikas Vigyan Samiti (GRAVIS), Rajasthan
3/437, 458, M. M. Colony, Pal Road, Jodhpur 342008, Rajasthan; Tel: 91-291-2785116; Fax: 91-291-2785116; email@gravis.org.in; www.gravis.org.in

Has been assisting the people of the Thar Desert to achieve water security, activities including building water harvesting structures

Gram Vikas Navyuvak Mandal Laporiya (GVNML), Rajasthan
Laporiya, Dudu, Jaipur 303008, Rajasthan; Tel: 91-1428-218142; gvnml@gvnml.org; www.gvnml.org

Assists communities with climate change adaptation activities, including water conservation through rainwater harvesting

Dhan Foundation, Tamil Nadu*(from A. J. James, ICRA Management Consultancy Services Limited, Noida)*
18, Pillaiyar Koil Street, S.S.Colony, Madurai 625010, Tamil Nadu; Tel: 91-452-2610794; Fax: 91-452-2602247; dhanfoundation@dhan.org; http://www.dhan.org/

Helps in rehabilitating water harvesting structures with farmers' contribution and participation to improve the acquisition of water by restoring system efficiency

Tarun Bharat Sangh, Rajasthan*(from Ashish Gupta, Organic Faming Association of India, New Delhi; response 2)*
Bheekampura- Kishori, Thanagazi, Alwar 302022, Rajasthan; Tel: 91-141-2391092; info@tarunbharatsangh.org; http://www.tarunbharatsangh.org/; Contact Rajendra Singh; Chairman; rajendra@tarunbharatsangh.org

Mobilises communities on the issue of water & supports them in reviving the traditional systems of water management through construction of 'Johads' for rainwater harvesting

Centre for Science and Environment, New Delhi*(from Amitava Basu Sarkar, Society for Rural Awareness and Development in Himalayan Area, Dehradun)*
41, Tughlakabad Institutional Area New Delhi 110062; Tel: 91-11-29951110; Fax: 91-11-29955879; cse@cseindia.org; http://cseindia.org/taxonomy/term/20167/menu

Advocates policy reforms in the water sector to mainstream harvesting rainwater in both urban and rural areas

Council for Advancement of People's Action Rural Technology (CAPART), New Delhi
(from Jayant Biswas, District Rural Development Agency, Rajnandgaon)
India Habitat Centre, Zone-V-A, 2nd Floor, Lodhi Road, New Delhi 110003; Tel: 91-11-2464 2391; Fax: 91-11-24648607; capart@caparthq.delhi.nic.in; http://capart.nic.in/orgn/index.html;

Has sanctioned the many projects on rainwater harvesting involving the use of ferro-cement technology

From S. K. Gautam, Religare Enterprises, Delhi

Indian Agriculture Research Institute (IARI), New Delhi
IARI Pusa, New Delhi; Tel: 91-11-25843375; Fax: 91-11-25846420; director@iari.res.in; http://www.iari.res.in/

Developed the "Pusa Hydrogel" which can save the 40-60 per cent irrigation water for any agricultural crop or plantation

World Bank, New Delhi

1818 H Street, NW Washington, DC 20433 USA; Tel: 1-202-4731000; Fax: 1-202-4776391; pic@worldbank.org; http://web.worldbank.org/WBSITE/EXTERNAL/COUNTRIES/SOUTHASIAEXT/INDIAEXTN/0,,menuPK:295589~pagePK:141159~piPK:141110~theSitePK:295584,00.html

Funded the development of the "Pusa Hydrogel", developed by the IARI which can enhance nutrient use efficiency of plants mainly for nitrogen and phosphorus

Institute of Environmental Studies and Wetland Management, West Bengal*(from Name, Organization, Location)*

DD-24, Sector-I, Salt Lake, Kolkata 700064, West Bengal; Tel: 91-33-23341020; Fax: 91-33-2358 0967; contact@ieswm.org; http://www.ieswm.org/rain_centre/complted_project.htm

Has installed about 80 RWH systems in primary and higher secondary schools, mostly of rural areas in West Bengal which were funded by different organisations

Institute of Rural Research and Development, Haryana*(from Salahuddin Saiphy, S M Sehgal Foundation, Gurgaon)*

Plot No.34, Sector 44, Institutional Area, Gurgaon 122002, Haryana; Tel: 91-124-4744100; Fax: 91-124-4744123; smsf@smsfoundation.org; www.smsfoundation.org

Has built a rainwater harvesting-based drinking water supply system in a school at Patkhori village, Haryana, which meet the water requirements of 325 students

From Sunetra Lala, Research Associate

Utthan, Ahmedabad

36, Chitrakut Twins, Nehru Park, Vastrapur, Ahmedabad 380015, Gujarat; Tel: 91-079-26751023; utthan.ahmedabad@gmail.com; http://www.utthangujarat.org/livelihood.htm

NGO works on issues related to gender empowerment and livelihood security, one approach is to promote rainwater harvesting to meet community level water requirements

Barefoot College, Rajasthan

Village Tilonia, via Madanganj, District Ajmer 305816, Rajasthan; Tel: 91-1463-288204; Fax: 91-1463-288206; barefootcollege@gmail.com; http://www.barefootcollege.org/prog_rwh.htm;

Provides training on implementation of rainwater harvesting; and issues such as drinking water, health and sanitation, social awareness and conservation of ecological systems

Society for Promotion of Wastelands Development (SPWD), New Delhi

14-A, Vishnu Digamber Marg, Rouse Avenue Lane, New Delhi 110002; Tel: 91-11-23236440/387; spwd_delhi@yahoo.com; http://spwdindia.org/t_water.php

Actively involved in analyzing and documenting causes of natural resource degradation, with a focus on reviving the practice rainwater harvesting in India

Samaj Pragati Sahayog, Bagli

Bagli, District Dewas, Madhya Pradesh 455227; Tel: 91-7271-275757; samprag@gmail.com

Has developed a Watershed Works Manual for those involved in implementing and monitoring RWH activities, through which rainwater harvesting activities can be taken up

Advanced Centre for Water Resources Development and Management (ACWADAM), Pune

Plot No. 4, Lenyadri Cooperative Housing Society, Sus Road, Pashan, Pune 411021, Maharashtra; Tel: 91-020-25871539; acwadam@vsnl.net; http://www.acwadam.org/res1.htm

Evolved mechanisms of integrating principles of hydrogeology and hydrology for rainwater resource harvesting and management

Action for Food Production, New Delhi
25/1-A Pankha Road, D-Block, Janakpuri, New Delhi 110058; Tel: 91-11-28525452; Fax: 91-11-28520343; afprodel@afpro.org; http://www.afpro.org/success.htm#16; Contact D. K. Manavalan; Executive Director; ed@afpro.org

Socio-technical non-governmental organization working on implementing rainwater harvesting works as part of their efforts to promote effective natural resource management solutions

Recommended Portals and Information Bases

From Sunetra Lala, Research Associate

IAH-MAR Managed Aquifer Recharge, International Association of Hydro-geologists, USA
http://iah.org/recharge;

A forum for information on the management and enhancement of aquifer recharge, a vital tool in the sustainable management of the world's underground water resources.

3R Valve
http://www.3rvalve.com/index.php?page=22;

Shows how small-scale water harvesting systems could be used for large-scale groundwater recharge

The Global Rainwater Harvesting Collective, Barefoot College, Rajasthan
http://www.globalrainwaterharvesting.org/; bunker1945@gmail.com

Aims to build on the rainwater harvesting knowledge, technology and skill that has existed with rural communities across the world

rainwaterharvesting.org, Centre for Science and Environment, New Delhi
http://www.rainwaterharvesting.org/

An information and data base on rain water harvesting and various water conservation initiatives

Rainwater Harvesting- India Water Portal, Arghyam, Karnataka
http://www.indiawaterportal.org/channels/rainwater-harvesting
Information and database on case studies, research papers, courses, policies and laws related to rainwater harvesting

Recommended Tools and Technologies

The Rainwater Harvesting e-Toolkit, Margraf Publishers GmbH Scientific Books, Germany *(from Sunetra Lala, Research Associate)*
http://www.rainwater-toolkit.net/index.php?id=18; Contact Hans Hartung; Tel: 49-15-79343071; info@margraf-publishers.com

Provides a learning module for understanding rainwater harvesting with several case studies from different countries on successful implementation of rainwater harvesting

Related Consolidated Replies

Water Harvesting for Adapting to Climate Change, Om Prakash Sharma, Wells for India – India Office, Udaipur (Experiences, Advice). Water Community and Climate Change Community of Practice, Solution Exchange India,
Issued 23/08/2010. Available at ftp://ftp.solutionexchange.net.in/public/wes/cr/cr-se-wes-clmt-15061001.pdf (PDF,Size: 499KB)

Seeks inputs on experiences on improvisation of Small Scale Water Harvesting Systems in order to best adapt to climate change or variability

Rooftop Rainwater Harvesting for Rural Schools in Karnataka, from S. Vishwanath, Arghyam and Rainwater Club, Bangalore (Experiences). Water Community, Solution Exchange, India, Issued 9 May 2008
Available at http://www.solutionexchange-un.net.in/environment/cr/cr-se-wes-04040801.pdf (PDF, Size: 500 KB)

Shares a range of RHW experiences, outlined ways NGOs can facilitate the implementation of these programmes and discussed different types of RWH tanks

Roof water Harvesting in Urban Areas for Groundwater Recharge, from Mihir Maitra, India Canada Environment Facility (ICEF), New Delhi (Experiences). Water Community, Solution Exchange, India,
Issued 22 August 2006. Available at http://www.solutionexchange-un.net.in/environment/cr/cr-se-wes-22080601.htm

Discusses the challenges, and available mechanisms/systems through various experiences of roof water harvesting

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Responses in Full

Suman Apparusu, Consultant, Hyderabad
This is an important query to sensitize and mobilize rural and urban populations alike, on the goal of water augmentation and preservation.

To answer the questions very broadly, I would like the member's attention to Jal Bhagirathi Foundation's project component supported by the Italian Development Cooperation for the Pali, Marwar, Jodhpur and Barmer districts of Rajasthan. Close to 500 water harvesting structures across 400 villages seem targeted by the programme. (http://www.jalbhagirathi.org)

The Ajit Foundation is Jaipur, has developed a user friendly simTANKA simulation software to simulate the performance of RWH systems with covered tanks. There are GIS elements incorporated in this S/W programme.

The suggestion is to contact and appreciate the existing body of work and adapt it to suit local conditions.

I do hope that the leads prove helpful.

Satya Prakash Mehra, Rajputana Society of Natural History, Rajasthan *(response 1)*
Hearty wishes to Mr Niranjan Singh-ji for circulating such an important issue which is the need of the time. We lost our traditional approach of conservation and the results are in front of us.

I will share the approach of one of the community which is known for their efforts to provide water for the larger section of the people. This is "Banjara" community. We use modern scientific techniques to assess the water level but their precision of pointing water is based on the what we say in modern terms is assessment of water flow pattern (both surface and underground). The

presence of vegetation is one of the criteria of these people to check the water conditions. They also assess the terrain and then soil moisture.

Our *Project Boond V* which was executed in Chak Ramnagar (Banjara village), Bharatpur, Rajasthan, used their approach and understanding of formation of well. Although, we used toposheets/ground level water conditions to assess the water availability, we took into consideration the experiences of the elder of the community. The result of traditional approach mixed with modern scientific techniques could be seen in Chak Ramnagar where the new well has sweet/ drinkable water and all other wells in the surrounding areas have saline water.

Further, I would like to share my experiences from the rural and tribal community side to whom I think if given chance to develop will prove to be far much more better and accurate then the modern techniques of harvesting water.

I have similar examples from the Abu Hills where the local community people devised a way to harvest water in the hilly terrain. Though they were not educated (class third passed out) but they knew the principle of siphons and concept of gradient flow. They used similar techniques and increased the availability of water in their farms. We all know that Abu Hills receive highest rainfall in Rajasthan but most of the water runs off or leaches into the ground. These farmers retain the water on the surface through their age-old practices of harvesting for a substantial time during their farming.

Many of the traditional techniques are not documented and given any term, but local dialects have one or same meaning of rainwater/surface water collection/storage in form of pokhars, baolis, tankas or nadis and many more. These are all based on local traditional knowledge with scientific foundations. It is due to these only one could find big "tanks" with the well planned drainage system for the collection of surface runoff in the historic palaces and forts. Many of these historic works are well-documented in small books (such as *Rajasthan ki Rajat Boonden* by Anumpam Mishra) available in regional languages. A research work was also carried out by one of the worker in Udaipur (Rajasthan) on similar aspects.

Now, to answer the issues which are raised here in the query

1. How can these made more efficient, e.g., using GIS for locating RWH structures better, newer materials to increase collection efficiency?

Here, I would state that they are already much more efficient than any of the modern scientific approaches (my personal views based on experiences). They only need protection and promotion. Our rural communities do not know anything about geographic information systems (GIS) and if we put forward such an approach they may fear and lose confidence in their knowledge. This fear keeps them away from their age-old practices of harvesting and conserving resources. I am not against the GIS or RS but use them in labs but also listen what our traditions and conventional knowledge gives us. Extract the parts which are useful and logistically fits.

Our age old practices are already have a strong scientific basis, but with over time many of them have been distorted and what we have now is not the original. It is our duty to present the correct format of our age-old harvesting techniques through learning and promoting the last seeds of knowledge in the rural/ tribal communities.

2. What are the considerations to keep in mind when using the water for drinking, watering animals and agriculture?

Again if we take into consideration the modern approach then we could easily find out which water has to be used for what, but let's consider the traditional knowledge of the local community. How to maintain the soil moisture: By storing water in the field for a particular number of days and then empty the fields, a common phenomenon in the semi-arid parts of

Rajasthan. Flowing water has to be made available for storage and then reused for other purposes, such as watering animals. Construction of wells for drinking near mass storage of surface water is yet another common practice which now-a-days is also used by government engineers in the rural areas of north-eastern Rajasthan.

Thus, I would state that

a) Traditional knowledge/ practices need protection and promotion
b) The local community of particular area has the ability to harvest water as according to the local availability of water (which may be rain or surface runoff) so we have to encourage their strategy
c) Giving respect to local culture of harvesting water instead of discarding straight forward on the basis of modern sciences
d) Modern approaches should be used only after taking advantage of local traditional knowledge then only we could be able to save our eco-centric culture of India.

A L Khan, Uttar Pradesh Irrigation Department, Lucknow

Rainwater harvesting can be done in the following ways:

1. Roof-top rainwater harvesting. Construct a pucca tank at ground level and connect it with the roof of house with a pipe. The rain water can be collected in the tank. This water may be used in domestic purposes along with drinking after boiling it. The dimension of the tank will be in proportion of the roof size
2. Open wells. The rain water may be collected in existing wells in home for domestic purposes or constructing a large size well in the field for supplemented irrigation to crops.
3. Rain water for supplemental irrigation. Rain water may be collected on agricultural land by constructing tanks in the fields for supplemental irrigation in non-rainfall periods to crops. the size of tank will be in proportion of field size
4. Development of ponds. Rain water may be collected in existing ponds by re-modeling them or constructing new ponds
5. Collection of rain water in existing drains. Rain water may be collected in the existing drains in the area by constructing check dams or sub-surface dykes cum check dams as per ground conditions. This collected water may be utilized for domestic and providing water for animals, irrigation and recharge groundwater for open wells or tube wells
6. Dams/reservoirs-constructing dams/reservoirs in river basin for collection of the runoff water
7. Circular ditch. Constructing circular ditches around the trees for orchards development.

N Lakshmi Narayana, Geohouse, Hyderabad

It is fact that we all are facing water crises and this is going to be more complex. Knowing the situation is not the end and it guide us to think for future with sustainable solutions. I am familiar with the geological and hydrological environment of Rajasthan. Some of my reflections and suggestions include:

- Use and renovation of TANKAS will be effective and are essential
- Map the groundwater resources using geological, hydrological and geophysical investigations or use the data available with GSI, CGWB, State Groundwater Department and other agencies
- Develop the tankas both on individual and community base
- Provide support and facilitating services for developing and managing the tankas
- GIS helps the agencies for analysis and monitoring purpose
- Develop bigger tanks for each villages, developing subsurface storing structures will be more beneficial to minimize the evaporation

- Map the salinity of the groundwater and initiate ways of reaching the groundwater for long term benefits
- This can be done with recharge wells or dug wells or existing structures
- Use local resources including the manpower on project life cycle basis with community ownership

I hope these measures help to enhance the water resources both on surface and subsurface for short term as well as long term benefits.

Looking forward for better networking and thus to reach the target groups with sustainable solutions matching to their needs and demands.

Ashish Gupta, Organic Farming Association of India, New Delhi *(response 1)*
While water harvesting and other techniques for managing water savings are always welcome, what good are these for farmers when they are routinely routed either by big corporates or water mafias?

A recent case in point (attached, ftp://ftp.solutionexchange.net.in/public/wes/cr/res-18031101.pdf, PDF, 613 Kb) is that in a small village in Himachal Pradesh, where a micro-hydel project actually lifted all water needed for downstream farmers and left the river dry. What good is creating a kufr or johad when the source of water is simply sucked out. India is mainly a rainfed-farming country. The remaining time farmers and the people either depend on natural sources or any harvesting that they can do. But no matter what harvesting, it can only be done in a limited manner by people and it is almost impossible to sustain themselves without natural sources throughout the year. Since we cannot go around forcibly creating glaciers for more water, at least in the mountains there other traditional methods of harvesting are possible.

In Himachal people do create ponds on top of mountain tops so as to recharge wells and natural streams below the mountains. In Uttaranchal filtration wells have been created by the grassroots foundations. Encouraging local vegetation around natural water sources and by the side of river channels is another way to ensure that water accumulates in the soil and keeps providing for natural streams throughout the year. Bio-diverse local afforestation projects are most successful for this purpose. However, care must be taken in the type of biodiversity encouraged e.g., in Himachal Pradesh, planting Roxburghi Pines has actually ruined mountain sides by causing a semi-mono-cultured forest instead of planting Deodhar pines, which are slow growing but allow other natural forest to grow around them, would have been better.

All in all – any harvesting done to promote communal water bodies and natural sources should be best and most sustainable. The attachment is a case in point which has been very contentious to the cause of the farmer with government apathy and the corporate juggernaut on the roll.

While water harvesting is a stop-gap arrangement to provide short supply one must simply focus on how natural sources of water can be rejuvenated so as to have perennial supply of water.

O P Sharma, Wells for India – India Office, Udaipur
Last year we had an interesting discussion and inputs from members on similar query, "Water Harvesting for Adapting to Climate Change" (Available at **ftp://ftp.solutionexchange.net.in/public/wes/cr/cr-se-wes-clmt-15061001.pdf (499 KB))**.

Wells for India with its partner NGOs in the drylands of Rajasthan have for last 24 years worked intensively on the revival and adaptation of water harvesting to variability of rainfall in different agro-climatic zones of Rajasthan.

The work done by our partners organizations like Gramin Vikas Vigyan Samiti – GRAVIS (www.gravis.org.in) in the Phalodi block of Jodhpur district on the adaptation of traditional water harvesting tankas to rainfall variability. The Jal Bhagirathi Foundation (www.jalbhagirathi.org) has worked on water harvesting works and Gram Vikas Navyuvak Mandal Laporiya– GVNML (www.gvnml.org) on the Chouka systems. These are few of many examples emerged from Rajasthan on adaptation to climate change.

I also attach proceedings of the conference held in Jodhpur in Feb 2010 by Wells for India and Jal Bhagirathi Foundation on the subject. Many of the papers presented by eminent scientists, academicians, civil society were discussed and debated. I do hope this will be useful. (ftp://ftp.solutionexchange.net.in/public/wes/cr/res-18031102.rar, RAR, 2 Mb)

Bhaskara Rao Gorantla, APMAS, Hyderabad
Greetings! This is a timely query to meet the formidable challenges posed by the climate change. I have worked for a decade (1996 - 2005) on restoration of traditional water harvesting structures in Southern Andhra Pradesh - known as Rayalaseema, a chronic drought-prone area. Around that time I also worked on research project - *Household Coping/ Survival Strategies in Drought-prone Regions: A Case Study of Anantapur District, Andhra Pradesh, India* (ftp://ftp.solutionexchange.net.in/public/wes/cr/res-18031103.pdf, Pdf, 656 Kb). In these works, I got inspiration from the works of Rajendra Singh bhai of Tarun Bharat Sangh of Alwar district, Rajasthan.

In Rayalaseema, Tanks – which are basically surface irrigation structures – fell into disuse and became defunct because of several reasons. One of the important reasons is the changes in the catchment areas. GIS can help in resolving this problem. GIS may also help building cascade/ chains of tanks to optimize the rain water conservation. In Rayalaseema and other parts of South India building of chain of tanks was perfected hundreds of years ago.

In arid and semi-arid regions, mixed cropping, especially agro-forestry is the major solution. The green cover plays an important role in improving the soil moisture and productivity. Leaf litter will increase the organic content in the soil and increase the soils' water absorption and retention characteristics. But introduction of evergreen trees like Prosafis Juliflora may drain out ground water and sub-soil moisture. Deciduous trees could be the solution.

Pathak R Kripal, National Horticulture Mission, Ministry of Agriculture, New Delhi *(response 1)*
It is my pleasure to receive the mail on International Water Day. Many thanks for sharing good news. In response to this I just attach a mail regarding Homa Therapy which can mitigate the current crises of water, soil and the ailing environment. There is need to promote this. In case any technical help is required, please feel free to ask. This is time to get the like-minded people to join and try to save the mother nature. You can view the file at ftp://ftp.solutionexchange.net.in/public/wes/cr/res-18031105.pdf, PDF, 166 Kb).

Jyoti Sharma, FORCE, New Delhi
Despite so much awareness generation efforts for Rainwater Harvesting, it still remains a largely NGO-led activity. Wherever, there are active, committed NGOs willing to help people with

technical help, implementation support and most often – also with funding support – it is adopted by local communities. Of course, the number of cases where the communities themselves take proactive interest, take responsibility and arrange for the resources necessary to construct and maintain such structures is increasing– however, it has not become a mass movement.

I think that is probably because a crucial link is missing. The focus is on the physical act of reviving the traditional Rainwater Harvesting structures. Though that is very necessary, perhaps we also need to give equal attention to revive the traditional localized water planning mindsets. Traditionally rainwater harvesting was the accepted norm – because it was a necessity. Because the planning unit for water was the village / taluka – not even the 'Watershed'. A village knew that its lives and livelihoods depended on the water it could store during the monsoon – there would be no other source available later. And hence, the whole village was united in taking care of its ponds, wells, catchment areas and monitoring of usage. Our forefathers even designed religious rituals to make sure that necessary things like annual cleaning of ponds, protection of wells, etc., was done unquestioningly by the villagers.

Do you think that the shift in the Water Planning paradigm – from self-sufficiency in Water to Water demand based planning heavily dependent on import of water / overdrawal from water banks - is partly the reason for RWH not becoming a mass movement? Do you think that because we do not have any self-imposed limitation on the quantity of water we can legitimately demand, that we end up focusing on 'sourcing' water rather than 'saving & then using water'. It's a bit like the credit card culture we live in now – if you don't have money now, don't bother saving – get into the borrowing cycle and live off potential earnings for the next 15 years.

To get policy makers (including Minister of Water Resources) to think about this concept, in a recent program we organized – Walk for Water 2011 (aligned with the Global Walk for Water campaign), we have advocated the 'Blue Delhi Declaration' i.e. Delhi must plan to first maximize the use of its internally available water resources before it destroys any more mountains, forests and villages to import more water into the city. With 629 lakes, 900 billion litres of annual precipitation, a perennial river, water recycling plants, laws, 30% green cover and a ridge that protects from desertification… this is very much possible.

Nitya Jacob, United Nations Children's Fund (UNICEF), New Delhi

I have visited the sites where Niranjan-bhai works while I was researching for Jalyatra, my book on India's traditional water management systems. Shekhawati is a fairly dry but well-populated part of the Rajasthan desert, with spectacular sand dunes underlain with very saline groundwater. I saw the bleached bones of dead cattle who had drunk groundwater – it is so salty that combined with the summer heat, drinking it brings on death in a few days. The people in Shekhawati and indeed across Rajasthan in a belt that stretches up to Jodhpur and Pali have an amazing variety of rainwater harvesting systems. There are tankas for drinking water, talaabs for other domestic use and watering animals and johads for agriculture – wherever the sandy soil allows it. I distinguish between johads and talaabs since they are both similar – most of the johads were essentially mud and stone wall impoundments of rainwater. The talaabs were more permanent, made of stone mortar. Tankas have a small circular catchment made of cement or lime mortar from where water is funneled into a central underground tank and is used only for drinking. The other two have large catchment areas comprising hills and dunes from where rainwater runoff is collected.

Much further south in Bundelkhand, there are thousands of ancient multipurpose talaabs built by the Bundela rajputs. All of them have uniform architecture, where the water facing wall is covered with stones. The main retaining wall is made of stone filled with clay, so it is semi-porous. Steep steps lead down to the water. Their catchments as in Rajasthan are also the

surrounding hills or sloping land. Even further south, in Andhra Pradesh, Karnataka and Tamil Nadu, talaabs (or tanks) served the same purpose. In Tamil Nadu they are sometimes organized into tank cascades – a set of tanks inter-connected with channels to carry the overflow from one into the next and so on, till they join with a local river.

What is striking is the simple ingenuity of these rainwater harvesting schemes. They store enough water to tide over several rainfall-deficient years, maintain groundwater levels and provide livelihoods through fishing or horticulture in the dried-up portions of the tank beds. There were elaborate social mechanisms to look after them and keep people from polluting the water but unfortunately these have fallen apart – and need to be rebuilt quickly. These structures need to be restored if these dry areas are to have any sort of water security against the climate variability since there is no land for making new ones – some tanks cover hundreds of hectares and it would be extremely costly to build new ones.

The Madhya Pradesh irrigation department that 'maintains' some of the large tanks had prepared a proposal for the restoration of tanks in Bundelkhand where it stated this was economically feasible. However, this has not seen the light of day. An engineer I met strangely enough said the department had 'condemned' the tanks since their 'life was over'. A structure that has existed for 1000 years has suddenly become dispensable in just 60 years? The same proposal clearly said if restored, these structures can meet the water needs of the region – drinking, irrigation and watering animals. Unlike in Bundelkhand, Rajasthan has an active set of organisations working to conserve these structures.

For restoration, I suggest the following. First, satellite imagery can help identify these structures since some of them are so filled up or have fallen apart. They need to be demarcated and classified by type, size and purpose. For example, talaabs with mud walls, talaabs with stone walls, acreage, possible use, type and area of catchment and command, encroachments in the catchment and feeder channels. The second step would be to visit and verify satellite data, assess the state of the structure and restoration possibilities, and calculate the volume of water that can be stored if the structure is fully restored using GIS. The third would be to approach the local authorities with this information and get them to remove encroachments – usually new settlements or seasonal farms. The fourth would be physically demarcate the catchments and commands of each structure using a mix of GIS and satellite data. The fifth would be to tap into government funds under various schemes for the restoration of these structures. The sixth would be to mobilise villages in the catchment and command, all of whom benefit from the water in the pond, to form a committee for its restoration and make a plan. The seventh would be to start restoration from the most degraded part in a time-bound manner to make use of the monsoon rains. If the impounding walls need repair, that can be eighth step; their structural integrity would have to be checked with advanced non-destructive methods and repaired with the same techniques used for constructing them. The ninth step is to ensure the longevity of the structure by regular maintenance, protecting the catchment from encroachment, and using the water wisely (this would also include changes in cropping patterns in the command area in keeping with local rainfall and water availability). Finally, the committee members need to draft rules for maintenance and regular testing of water quality.

Water quality and quantity are two considerations to keep in mind while deciding what the water in these structures will be used for. There are well-established protocols for water testing. Drinking water should get the highest priority, followed by water for other domestic use, water for livelihoods (including animal husbandry), water for farming and finally water for the local eco-system.

A. J. James, ICRA Management Consultancy Services Limited, Noida

While I agree with the idea that traditional rainwater harvesting structures need to be revived as part of the efforts against the impact of climate change, I believe that this is not enough.

For one, the inflow channels bringing water to fill traditional rainwater harvesting structures have been badly affected by development. As the Dhan Foundation in Tamil Nadu has found, in their (very commendable) efforts to revive traditional bodies, there are now roads, bus stands and other symbols of 'development' that block the way in which rain water used to flow into these bodies. A similar finding from research in Karnataka and Andhra Pradesh (by Charles Batchelor et al in 2002) showed that check dams constructed upstream of community tanks stopped water flowing down into these tanks, and that the effect was worse during low-rainfall years. Therefore, even if these structures are repaired and revived, they are not likely to harvest as much was as they used to do. This paper is available at ftp://ftp.solutionexchange.net.in/public/wes/cr/res-18031107.pdf, PDF, 200 Kb.

Second, rural communiites have coped with droughts and floods in the past - but these may no longer work. For instance, to cope with failures of rain, communities in semi-arid India had created 'buffers' of food (through grain banks), water (groundwater was available even rains failed and so drinking water wells did not run dry) and cash (in the hands of rich farmers who then were obliged to look after their workers).

Third, community efforts are not enough - and were not enough even historically, when kings and then the Mughals and British, set up a myriad of drought relief public work, giving workers food and cash to survive the lack of agricultural employment due to the drought. And yet, droughts and famines killed millions, especially from the latter half of the 19th century.

And it is the same today, while preparing for climate change - whether it is excess or more frequent rains or consecutive years of droughts, more intense or more frequent droughts. It cannot be done by communities alone. Systematic application of pre-set measures, on the lines of disaster mitigation, has to be done in a coordinated manner by government agencies. This is where there appears to be a major disconnect between the National Disaster Management Agency (which has developed drought mitigation and flood management plans) and the state government agencies, and particularly at district-level. And this requires serious and urgent attention - as the many droughts and floods of recent years has shown.

It is therefore high time that we thought through new coping mechanisms and management strategies for the possible impacts of climate change, particularly at the community level, and informed a collective and concerted efforts by PRIs, Line Department staff and community groups, so that they have a better chance of dealing successfully with the uncertain weather patterns of tomorrow - and some would say, of today, since we seem to have begun experiencing the impacts of climate change already!

Finally, I also feel it is high time that we used the tools available at our disposal today to address the uncertainty of climate change systematically and efficiently. A recent compilation of useful methods is in Batchelor et al., Thematic Overview Paper on Climate Change and Implications for WASH, 2011, IRC, forthcoming.

B. L. Kaul, Society for Popularization of Science and Progressive Educational Society, Jammu

In Jammu and Kashmir we have some upland areas called Kandi where, despite sufficient rainfall, there are no facilities to retain rain water. Rain water just flows away and causes floods downstream. In the Jammu Division, for example, we have the Shivalik hills running from the Kathua District through Samba, Jammu and Udhampur Districts right up to the Rajouri District

covering nearly 250 Kms. The whole area is Kandi i.e., rainfed. There were more than 500 ponds dug millennia ago which were used for centuries. The whole area was covered with evergreen bushes and lush scrub forests till nearly 70 years ago but unfortunately these were destroyed and today Jammu's Shivaliks wear a desolate look. Although the area receives about 50 inches of rainfall, not an inch is retained by these hills due to lack of green cover and the ponds. The traditional ponds have mostly disappeared having been encroached, filled up or lost due to disuse.

The results have been disastrous for the people of the area who are mostly themselves to blame for it. The most important step that needs to be taken on priority is to revive the traditional ponds. This will help to retain water and help groundwater recharge. The other steps that need to be followed are watershed treatment through gali plugging, check dams and vegetation. There are numerous seasonal streams though which rain water rapidly runs off and is lost. These streams should be diverted to fill the traditional ponds and reservoirs. Besides, plantations and watershed programmes can help to regain the eco-development of the area and provide opportunities of cultivation of crops and horticulture and help alleviate poverty.

Use of traditional wisdom along with modern methods of harnessing and harvesting rainwater, if taken up in right earnest, can prove to be a panacea in our country which is otherwise going to face an acute water shortage in the near future. The writing is there on the wall.

Shrikant Daji Limaye, Ground Water Institute, Pune

The story from Mr Bansi Lal Kaul is similar to some areas in south India with only difference that the rainfall at Jammu and other districts like Udhampur is about 1,200 mm while we receive only 350 mm.

Is there any government project for watershed protection, forestation, desilting of old ponds and soil & water conservation, taken up with active participation of local villagers? If not, what happened to the crores of Rupees spent on J&K state having a special status? Are there any NGOs active in this field?

Satya Prakash Mehra, Rajputana Society of Natural History, Bharatpur

I agree with the views of A J James on the issue of changes taken place with the pace of developments. But incorporating the recent advances in shaping the traditional age old practices remains my priority and my input.

In my earlier response, I had given the example of the Banjara community. Historical facts (at least for Rajasthan) show that the Banjaras used to facilitate the rulers and even invaders by arranging the basic logistics. Water used to be the main resource. The age old wells or pokhars / talaos (ponds/lakes) in many historic areas were created by the Banjaras. Traditionally they are also known as "Well Digging Community" as they were having the talent of locating sweet water even in arid areas. Many of the historic lakes of Rajasthan were also made by Banjaras. If we study the sites of those lakes, one could find that how scientifically they planned the site which have the regular influx of water. If we study the wells in human habitat areas then their vision of recharging mechanism become clear.

Also, let me share that many of the facts are still waiting documentation. Please find one of the link to see such type of water harvesting story published in Opinion column of Editorial Page on 18 March 2011 titled, "Come Munwa, drink water" in Hindi (Aao Mumdwa, Pee Lo Paani) (http://www.rajasthanpatrika.com/news/Opinion/3182011/Opinion/138290)

If we (modern practitioners) respect our traditional conservation practices then we could gain more scientific knowledge rather than following blindly the only modern means. Our traditional practices are already science-based. We are gaining advantage of their (Banjaras) knowledge in our working areas in Bharatpur and also taking advantage of modern tools to justify and authenticating their knowledge.

So my input is why not to revive their ability to explore the water potential and then incorporating the advances (such as GIS & RS) to implement new work.

James Baldwin, Water and Sanitation Consultant, Goa
I agree wholeheartedly with A J James that a more coordinated approach to coping with drought is necessary. I do believe, however, that communities do have the ability, with proper technical guidance, to help themselves within their own villages and farming areas. I give below two examples from my own experience that illustrate this:

In Shendola Khurd village in Amravati District of Maharashtra development of roads and housing had impacted the traditional wells in the village, causing water in the wells within the village to dry up owing to a lack of natural recharge. A solution to this problem was to use the roof area of buildings, collected through a system of gutters and pipes, as recharge points for each well. This was done by villagers themselves with outside advice but very simply and at low cost. Roads can also be used as channels for run-off collection, with a bit of work on the edges and, of course, the inclusion of properly designed filters.

In Mandvi, Gujarat, the impact of farmers deciding to take up recharge check dams across nallahs that only run with rainwater for about 5 days a year was dramatic - wells recovered remarkably. This was partly due to excellent design of the recharge well, effective guidance by an NGO and also the favourable geology. Nevertheless it was only really due to the farmers that the overall impact was so good - motivated by the fact that they could grow crops that they could never have contemplated previously.

Ashish Gupta, Organic Faming Association of India, New Delhi *(response 2)*
Nitya's reply and in specific all replies pertaining to how the government reacts to traditional water conservation mechanism there is a comment which should be warranted.

Is there any government body at all which focuses on traditional water conservation structures. Various NGOs listed in this mail chain have done a very commendable work and Rajender bhai's work as part of Tarun Bharat Sangh will now be listed as part of the history of our generation.

It may also be prudent to state a historical point that after the Moguls, the British did the most damage to traditional water conservation structures by imposing their own Western policy, systems and mechanisms and discouraging traditional systems, which is where the government policy now stems from. The famines in Bengal, Maharashtra in the 18th and 19th century due to this is well known (Refer to the publication, *Diversity - The Hindustan Way* by Navdanya Publications).

Since then there has been no known (maybe my ignorance here) of government initiative to study, research and revive traditional water conservation mechanism some e.g., to this end are - Even today if we go to any wild life sanctuary water holes for animals are made of cement! Subsidies are provided by the government to construct cement concrete tanks instead of traditional water harvesting structures in villages.

Here is a serious case in point – the celebrated Sardar Sarovar Dam has provided water to places in Rajasthan such as Sanchore which did not have any artificial sources of water before but now has a flourishing farm system. However a number of farmers downstream on the River Narmada within Gujarat towards the sea coast and inland have started complaining of a strange phenomenon - they say since the Sardar Sarovar dam has been built, their farm soils and underground water have started getting more and more saline. The theory floated to this end was probably due to the reduced flow of Narmada and probably any underground rivers associated with it has caused ingress of sea water through underground channels. This fact was casually discussed with a senior officer of the Sardar Sarovar Project who justified such an occurrence (if any!) compared to the 20:1 benefit by people since the dam was built. He also commented that it was the job of the government to decide these facts.

Rajendra bhai commented in a meeting in Thandapani, Tehsil Karsog (Himachal Pradesh) that traditional water structures should be constructed and maintained in the traditional manner passed down from generations. Cement/RCC should not be used at all unless all other measures are exhausted and that too in the most minimal way. Sadly, government policy now is to use Cement/RCC as the first case and traditional but sustainable methods are now disappearing. This coupled with extravagant schemes such as national river linking, micro hydel projects (as given in the email above) etc. are slowly killing what used to exist in this Beautiful Tree called Bharat! Something that the British tried to achieve slowly and the governments achieving at a pace faster than the GDP growth of the country.

Manoj Kumar Teotia, CRRID, Chandigarh
It's very crucial issue in the light of climate change. I work on urban issues in Northwestern area. The RWH is very poor and almost negligible in urban areas except in Chandigarh where I see few rain water harvesting initiatives in some schools and parks and it is through recharging wells. The Sukhna Lake is most important example of rain water harvesting as it receives water from Shivalik Foothills.

Ajit Seshadri, Vigyan Vijay Foundation, New Delhi *(response 1)*
Having been a keen rain water harvester for over a decade, I wish to add a few points the tussle between development on one side and environmental conservation on the other side is a known fact. It is only how prudently, we humans being humane to both nature and mankind tread the middle path.

Traditionally where there are RWH mechanisms functioning they should be revived and made operable on WAR footing, and where we can introduce a few mechanized initiatives viz., waste water recycling using natural methods, or adaptable enhanced rain- water storage and usage and conservational methods.

After all the traditional systems have functioned for ages, and with a few keen initiatives can be easily revived. These will work for ages. We have been popularizing O&M practices, i.e., Operational & Maintenance. word "O&M" is apt Members can easily propagate "OM" , we all relate well to this word.

Water ought to be given more respect, and not wasted, but conserved and re-used. All rivers, ponds, lakes and other water- sheds to be conserved and augmented.

Now coming to some pertinent questions. Is there any government body at all which focuses on traditional water conservation structures? The answer is NO. Even the initiative RWH is not being popularised as a general procedure. The Central Government and state governments run some

initiatives on RWH and others, only minimally, Some examples are those implemented in Tamil Nadu a decade earlier can be replicated.

The controlling departments, and the Authorities both at Centre and States ought to take up the responsibility of doing do-able initiatives for the sake of providing safe and secure water to citizens.

Satya Prakash Mehra, Rajputana Society of Natural History, Bharatpur *(response 2)*
I agree with views of Ashish Gupta. Traditional harvesting should include traditional planning rather than implementing the policies made by people sitting in their offices and suggesting the ideal structures of modern techniques. And that's why the majority of them fail. The ground reality is different and there cannot be the same approach at all locations due to terrain diversity.

What is the present scenario of the desert sites such as north-western districts of Rajasthan - Ganganagar, Bikaner? The example of Jalore as mentioned in Ashish's mail is yet another change caused by modern techniques. Our studies on the socio-ecological impacts of this change are still in progress but the early phase showed that the people are moving away from their traditional habits of water conservation as the thought that their water problems are solved has made them somewhat relaxed. Further, they are now changing their agricultural practices. We can already anticipate what will happen in the future when they will start growing crops requiring excess water. Besides, the human-wildlife clashes due to change in the agriculture patterns is rising.

So it is recommended to revive our traditional approach of conserving water using the traditional methodology to ensure success.

Simultaneously, planning for the altered habitats should be as per the requirements of the site, as stated in earlier views by several group members. This is especially true in the case of cities with cement-concrete construction. In such concrete jungles, the policy should be as according to what the policy-makers plan.

Rajan Aggarwal, Punjab Agricultural University, Ludhiana
Broadly we can do rainwater harvesting two ways. One is direct storage and other is through groundwater recharge. Direct storage is useful where rainfall is scanty whereas recharging can be done in alluvial strata. The Department of Soil and water Engineering of Punjab Agriculture University has developed technique for rainwater harvesting through rooftop for ground water recharge in All India Coordinated Research Project in Ground Water Utilization. We have also establish more than 40 structures at different places in Punjab.

Neelima Garg, Uttarakhand Jal Sansthan, Dehradun
To mitigate the impacts of climate change, revival of traditional water conservation practices such as tanks and Rain Water Harvesting (RWH)is an option for enhancing drinking water supply, wherein the stored water can be used for irrigating crops and for animals.

In Uttarakhand State, Uttarakhand Jal Sansthan has revived 2200 chals and khals by desilting. Chals and Khals are natural RWH structures. In the state in Rural Water Supply Programme, several RWH schemes have been made in the areas where there is no natural source of water by State Government Departments.

Amitava Basu Sarkar, Society for Rural Awareness and Development in Himalayan Area, Dehradun

India is a vast country. The geo-hydrological, topographical conditions vary a lot. Thus, it would not be feasible to come up with a one-fits-all solution for the entire geographical expanse of the country. We need to find out what is happening in different parts of the country and assimilate them and devise locally adaptable solutions. This has to be done by local experts.

I work in Uttarakhand state. Here rainwater is harvested mainly for two different uses: a) for domestic use, b) for recharging local water sources generally in the form of springs.

Domestic use: Water is collected from the roof using PVC pipes connected to a tank made of ferro-cement. In case of flat roofs PCC is used to form a bund around the roof, to ensure accumulation of water. For sloped roofs GI tin sheets are folded into a semi-circular shaped gutter and attached to the roof.
For recharge: Depending on the availability of space, ponds are dug upstream of the source to be recharged. The location of these dug ponds depends on the topography and the geo-hydrological condition of the locale.

Using GIS for locating the RWH structures may be done when dealing with large areas only, otherwise it will not be economically viable. I personally feel that a local geo-hydrological study, by local experts, aided by topo-sheets is a better idea. It will help identify locale specific solutions. Furthermore, it is always easier for the beneficiary community, to identify with simpler methods, which goes a long way to ensure sustainability. Using simpler methods also are easily understood and assimilated by the beneficiary communities and increases their involvement and confidence.

In assuming adequate availability of water, the principal consideration for different water usage (e.g., drinking, watering animals and agriculture) is quality. The quality of potable water has to pass the strictest standards. The rainwater harvesting tanks (RWHTs) in Uttarakhand, are mostly used for domestic needs, including drinking. To ensure quality of water is potable a filter is installed on top of the RWHTs and water from the roof passes through it into the tank. The water collected from the first rains draining the roof is not harvested and allowed to flow out of the system through a scour tee fitted with a plug. Chlorine tablets are used to ensure disinfection.
It would be pertinent to note here that in eastern India, water is carried using channels made by split-bamboo channels to be used even at the domestic level, highlighting local innovation, which is amply documented in publications from the Centre for Science and Environment. This assumes importance signifying the necessity of traditional knowledge and abundantly available local resources to overcome the lack of access to sophisticated resources in a sustainable manner, by the community themselves, without any external influence.

We need to acknowledge latest scientific advances and assimilate them to come out with solutions suitable to the local conditions. In this the role of this platform is enormous as it may act as a two-way conduit to ensure flow of information globally to locally and vice-versa. The local experts are central to the process, as they are familiar with the local conditions and armed with newer scientific inputs will certainly be able to reach solution most suited to their locale.

Devesh Bhardwaj, Consultant, Jaipur

During the period of my service as a public health engineer in the Public Health Engineering Department (PHED) Rajasthan, I have seen many traditional RWH structures particularly in the north-west part of the state. Mostly people have been using *Tankas* both on individual and community level. An artificial catchment is built around a central circular storage tank. The rainwater falling on this artificial catchment is collected in a central storage tank (generally built

in brick masonry with lime mortar and lime plaster. The water is drawn through pulley and rope arrangement. This water is used for drinking as well without any treatment. In parts of Churu district (Ratangarh and Sujangarh tehsils), I found that water collected during monsoon and winter rains lasts all through the year. In urban areas, the houses have arrangements for harvesting rooftop rainwater in *kunds*. As was gathered from the local users, before intervention of state government through public water supply schemes, these traditional RWH structures used to be main sources of drinking water.

In well-managed structures, the catchment is protected religiously. No one is allowed to walk in the catchment with shoes on.

For meeting the drinking water crisis faced by PHED in the state, it is essential to revive these traditional structures and fall back on them. A joint effort is required from the state PRIs, the NGOs and PHED for identification, revival and re-popularising these structures.

In areas where protection of catchment is not possible and the quality of collected water is likely to deteriorate with time, it is suggested to employ unit treatment processes of filtration (slow sand filters) and disinfection. The treated water may be stored in one day capacity clear water tank and may be drawn through Hand Pumps installed on the top of clear water tanks.

Jayant Biswas, District Rural Development Agency, Rajnandgaon
As you all aware the Council for Advancement of People's Action Rural Technology (CAPART) is an Autonomous organization under the Ministry of Rural Development. It has sanctioned the many projects projects on rainwater harvesting through ferro-cement technology as proposed by NGOs. This is a low-cost technology and easily affordable by communities.

Chari Appaji, Directorate of Sorghum Research (DSR), Hyderabad
We, at the Directorate of Sorghum Research, have constructed a rainwater harvesting system from rooftops for direct storage wherein which stored water is being used for irrigation.

S. K. Gautam, Religare Enterprises, Delhi
I am in touch with a product known as "Pusa Hydrogel" which has been developed by the Indian Agriculture Research Institute (IARI) and patented by it. The same product has been developed specially for Indian conditions which can save the 40-60 per cent irrigation water for any agricultural crop or plantation. The product can enhance the nutrient use efficiency mainly for nitrogen and phosphorus and others. The product is running under National Agricultural Innovation Programme (NAIP) of the Indian Council of Agricultural Research (ICAR) funded by the World Bank. The product is highly appreciated by ICRISAT, Hyderabad and practically by the farmers of MP and Rajasthan. Several researches on different crops at the all-India level have been conducted and research is still going on for the same product.

A major part of the rainwater can be trapped/harvested in the root zone of the plant or crop. The product is highly effective up to 50° centigrade soil temperature and in fact it is called as soil conditioner.

For further more information about this product any one can refer to IARI, New Delhi at their ATIC center.

Irene Stephen, UNDP, New Delhi

I would like to share with you resourceful reference, in response to your first question related to local RWH Techniques. There is a useful website on, "Water Resources Engineering and Management - developed under the National Programme on Technology Enhanced Learning, which has a training module on Irrigation Engineering Principles, which discusses Traditional Water Systems and Minor Irrigation Schemes in India.

The Asian Development Bank has published a study of select States 'rehabilitation and management of tanks in India http://www.adb.org/documents/studies/tanks-india/rehabiliation-management-tanks.pdf, (PDF, 250 Kb)

Books written by Anupam Mishra:

- Aaj Bhi Kharein Hai Talaab
http://www.indiawaterportal.org/sites/indiawaterportal.org/files/AajBhiKhareinHaiTalaab_AnupamMishra_LowRes.pdf (PDF, 150 KB)
- Rajasthan Ki Rajat Boonde,
http://www.indiawaterportal.org/sites/indiawaterportal.org/files/Radiant%20Raindrops%20of%20Rajasthan_English%20Translation%20by%20Maya%20Jani_0.pdf (PDF, 225 KB)

Tapan Saha, Institute of Environmental Studies and Wetland Management, Kolkata
At IESWM have installed near about 80 RWH systems in West Bengal funded by different organisations. Most of the RWH systems were installed in primary and higher secondary schools, mostly of rural areas, for drinking water purposes with the safety measurement. The storing capacity ranges from 10,000 – 9,000 litres.

Rajan Aggarwal, Punjab Agricultural University, Ludhiana
There is need to check evaporation losses with some low cost material particularly in state like Rajasthan where temperature is high in general.

M M Sharma, ICRISAT, Patancheru, Hyderabad, India
I have put some additional information below the input of Mr. Devesh Bhardwaj.

- Rainwater Harvesting and Management in India – A Household Perspective, ftp://ftp.solutionexchange.net.in/public/wes/cr/res-18031108.pdf, PDF 6.1 MB
- Economics of rainwater harvesting system, ftp://ftp.solutionexchange.net.in/public/wes/cr/res-18031109.pdf, PDF 22 Kb

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Ajit Seshadri, The Vigyan Vijay Foundation, New Delhi *(response 2)*
I would like to give some more info on conservation of water. Whilst members are deliberating on installing RWH initiatives and reviving old traditional initiatives, they can also consider implementing waste water treatment process and re-use for lower end uses. These initiatives are also cost-effective and helpful to communities. Only a caution is to be exercised, as it should not have toxic substances, and chemicals, etc. Basically, waste-water process of domestic sewage and sullages discharge can be done with natural methods and the recycled water is available all throughout the year. The initiative would also make the owners very satisfied.

Pathak R Kripal, National Horticulture Mission, Ministry of Agriculture, New Delhi
(response 2)

I read many contributors who are associated with water quality and availability. Water is as important as oxygen for our survival which is becoming alarming in most part of the world because of one or other reason. With this discussion I would like to share a unique experience of impact of Homa Therapy in mitigating water, soil and environmental crises. (ftp://ftp.solutionexchange.net.in/public/wes/cr/res-18031105.pdf, PDF, 166 Kb)

Salahuddin Saiphy, S M Sehgal Foundation, Gurgaon
I work with Institute of Rural Research and Development (An Initiative of the S M Sehgal Foundation) a trust working in villages of Haryana for Integrated Sustainable Village Development with Water Management as its flagship programme.

Regarding the Reviving Traditional Rainwater Harvesting methods for Climate Change Mitigation, I would like to share our experiences from Mewat. It is a semi-arid region and receives around 500 mm of rainfall. The surface water resources are scanty and groundwater is saline except few villages located along Aravalli foothills. The Aravallis generate a lot of runoff during the monsoon period but due to the high gradient of the porous and permeable fresh water zones, the water rapidly flows to low lying areas where it gets mixed with saline water or drains into the river without recharging the local fresh water aquifers.

Though, there is not much data available on rainfall pattern but according to local people, the number of rainy days has decreased whereas rainfall intensity has increased, leading to higher runoff rates and further reducing the recharge. The situation is further compounded by the indiscriminate extraction from fresh water zones and the rapid decline in water levels. The water quality of both groundwater and surface water is deteriorating day by day because of this.

To overcome this, we have created awareness among people on the importance of traditional water harvesting structures like ponds, *baolis*, dug wells for recharge, check dams, *medbandhi*, *nallah* bunding, etc., and people are adopting these interventions along with modern improved water management practices. We have created a rainwater harvesting-based drinking water supply in a school of Patkhori village where there is no other source of water; it was dependent solely on erratic and expensive tankers. Now the drinking water requirements of more than 325 students and teachers are met through rainwater stored in storage tanks which after filtration through bio-sand filters, automatically flows in taps.

There are many projects like this that combine tradition with modern science and appreciated by local communities, visitors and local administration. Now, not only community but district administration is supporting the cleaning, maintenance and renovation of old water harvesting structures and construction of new structures. The efforts has been appreciated by the Government of India as well as we recently won the 'Groundwater Augmentation Award-2009 from the Ministry of Water Resources, which is given for 'Innovative Practices of Ground Water Augmentation through Rainwater Harvesting and Artificial Recharge to Ground Water/promoting Water Use Efficiency/Recycling & Re-use of water/Awareness creation'. It was presented by Salman Khurshid, the Minister of Water Resources during World Water Day Celebration on 22 March, 2011 at New Delhi.

The model we have adopted is slow as it involves local communities and their traditional wisdom (science that they have learned through experience of over centuries) and fine tuning it with modern science to improve its efficiency. It started working and is giving good results and importance of traditional water harvesting systems has been realized by them as visible from the fact that communities and government departments have started its replication.

Anima Sharma, Independent consultant, New Delhi

Rainwater harvesting is a very old tradition particularly in the water deficient and dry areas with rocky terrain. During my visits to different parts of Gujarat, Rajasthan, M.P. U.P. and even Bihar and Jharkhand, I have found that people use different types of traditional methods to collect natural water and follow different ways to keep the natural water hygienically pure. For instance, traditionally they do not wash cloths or do other cleaning activities near the wells, prefer to wash clothes in the afternoon after finishing all chores and that too in running water (if available). If any animal falls in the well and dies then entire well has to be purified. But these things were observed in past, now we see that villagers are not all that conscious of all these things especially after getting the facility of tap water.

Local RWH techniques include collecting rainwater in overhead tanks directly from roofs, making the flow of the fresh water drains towards the available water sources, making large underground tanks connected to the fresh water drains which could be used in the times of need and several such methods. The local people have developed these time tested techniques but they use it in a crude way. We can plan properly to further improve these methods and use it at the community level at least. This collected water can be processed and purified for the drinking purposes. For watering animals and agriculture, large open tanks could be built. In fact, GIS methods would be useful in locating the suitable locations for water collection and building crevices, culverts and drains.

Rakesh. K N, Ashoka Trust for Research in Ecology and the Environment, Bangalore

A very interesting but informative discussion is going on the on the forum. Let me add few thoughts.

There were severe criticisms in the discussions against the usage of high end technologies like GIS application. For proper scientific planning we cannot keep away those advanced tools. But when dealing with the common man's livelihood problems, desk-top planning will always fail. He has to be taken into confidence, and consensus built at each step. There are many user-friendly tools like Google Earth for this. With a little effort any villager can learn to use Google Earth. Nowadays, its resolution is a few metres. This can be used as a powerful tool for identifying potential water sources, historical water bodies, plan of action for rejuvenation, etc. Almost all the basic applications of GIS are possible through Google Earth and later, if required, can be shifted to a proper GIS platform.

Starting from Chennai, legislations are in place in almost all the states/cities with regard to rainwater harvesting and ground water over-exploitation. But the fact remains that we are not able to solve the problem of over exploiting groundwater. Failure to strictly implement these legislations and regulations is one reason. But the rising demand also cannot be ignored. A serious discussion needs to dwell on how contain rising demand. Just by optimizing the usage we won't not able to meet the increase in the demand.

Another major problem is the present restoration/rejuvenation plans. In my experience in Bangalore, when the government (or authorities concerned) take up a restoration/rejuvenation plan, the basic hydrological nature of the water bodies (lakes) is changed. This will no doubt, will affect the natural storage and recharge pattern of the aquifer as historically many lakes are (were) connected serially. Additionally, there are threats to biodiversity and aquatic systems of the lakes. Therefore, the point is, when we allocating huge amounts for ground water recharge through restoration/rejuvenation of water bodies, if this is not done properly, it will have negative results.

In the case of rainwater harvesting also, many of the NGOs are vigorously promoting the collection and storage of water in concrete or PVC tanks. It may be required in some areas for some quantity of water. But unfortunately, a good number of people (including those who working on this field) have a feeling, RWH means collection of rain water in tanks. In the last two examples, the emphasis is on the need for change in the approach itself. Otherwise, the treatment is going to be worse than the problem.

Many thanks to all who contributed to this query!

If you have further information to share on this topic, please send it to Solution Exchange for the Water Community in India at se-wes@solutionexchange-un.net.in with the subject heading "Re: [se-watr] Query: Reviving Traditional Rainwater Harvesting methods for Climate Change Mitigation - Advice, Examples. Additional Reply."
