Book of abstracts
and convention brief

rainwater harvesting

3rd Bangladesh Convention

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3rd Bangladesh Convention
on Rainwater Harvesting

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ISBN: **978-984-34-2455-6**

Published in
March 2017

Printed by
Expressions ltd

Design
Al Emran and Expressions ltd

Published by
WaterAid
Bangladesh Country Programme
House 97/B, Road 25, Block A
Banani, Dhaka 1213, Bangladesh

programme flow

Thursday, 9 March 2017 | 09:00 to 16:30

09.00 Registration and Reception

09:30 Inaugural Session

Welcome speech
Dr Md Khairul Islam, Country Director, WaterAid Bangladesh

Keynote speech
Dr Sunita Narain, Director General, CSE, India

Speech from Special Guest
H E Johan Frisell, Ambassador, Embassy of Sweden in Bangladesh

Speech from Chief Guest
Mr Md Shahid Ullah Khandaker, Secretary, Ministry of Housing and Public Works

Conclusion

10:45 Tea Break

11:15 Technical Session 1: Potential and Practice of RWH

Session Chair: Prof Dr Feroze Ahmed, VC, Stamford University

Paper 1: Rainwater Harvesting in Real Estate Sector in Bangladesh
Dr Toufiq M Seraj, Managing Director, Sheltech Pvt. Ltd

Paper-2: Impact of initiatives of rainwater harvesting practices in WaterAid Bangladesh
Mr Arjen Naafs, Regional Technical Advisor-South Asia, WaterAid

Paper-3: Ultraviolet Disinfection for Rainwater Harvesting Systems
Dr M Ashraf Ali, Director, International Training Network (ITN-BUET)

12:45 Lunch

13:45 Technical Session 2: Policy and Prospect of Rainwater Harvesting

Session Chair: Dr ABM Badruzzaman, Professor, BUET

Paper-4: Legal framework, policy, strategy and challenges of rainwater harvesting in India
Dr Mahreen Matto, Programme Manager, Water Management, CSE

Paper-5: Prospects of Managed Aquifer Recharge as a Tool for Improving Groundwater Quality and Augmenting Quantity: Lessons Learned from the UNICEF-DPHE-AWN-DU Project
Dr Kazi Matin U Ahmed, Professor, Department of Geology, University of Dhaka

Paper-6: Setting an enabling environment for rainwater harvesting
Mr Arnoud Keizer Consultant, Rain Foundation, Netherlands

15:15 Panel Discussion & Closing Remarks

16:30 Convention ends with tea

foreword

It is with great pleasure that I pen this foreword for Book of Abstracts on the occasion of 3rd Bangladesh convention on rainwater harvesting. This book is the culmination of the hard work of a number of experts who have long been championing the rainwater harvesting, and reflects a growing body of knowledge that is indigenous, experiential, and of fundamental importance to the sustainability of our country's scarce water resources.

Tracing back, the origins of this journey lie back in 2010 when WaterAid Bangladesh conducted an analysis that found that there was little awareness, technological development or policy and legislation related to rainwater harvesting, particularly in urban areas. This was—and continues to be—a waste of our country's natural resources, especially given the persistent over-extraction of groundwater and rising water scarcity in many parts of Bangladesh.

There is growing acknowledgment of this missing link in policy and government circles. The National Water Policy 2013 included a commitment to facilitate availability of safe and affordable drinking water supplies through rainwater harvesting and conservation. The recent edition of Bangladesh National Building Code also contains guidelines on groundwater recharge infrastructures in buildings, which awaits for approval. However, policies need to be translated into action through effective implementation, and this is where the question of capacity, technology and an enabling environment come in.

Since 2010, WaterAid have been working to build this sector's capacity on urban rainwater harvesting, partnering with the Centre for Science and Environment (CSE) in India to jointly promote capacity building and technology transfer for Urban Rainwater Rarvesting (URWH). Over 150 professionals have been trained under joint endeavour of CSE and WaterAid Bangladesh, and these professionals are our country's pioneers in this emerging area of work. Alongside, we have partnered with the country's leading academic and research institutions to build demonstration plants, including at the Bangladesh University of Engineering and Technology (BUET), Independent University, Bangladesh (IUB), Shahjalal University of Science and Technology (SUST), University of Information Technology & Sciences (UITS) and Village Education Resource Center (VERC). The twin focus on theory and demonstration has spurred rapid development of our sector's capacity in this area, and created a network of professionals and practitioners whose research is presented in this book, and whose vision and drive will guide us in the coming years.

I will end on this note of vision – Global Goal shows us a vision of a country and a world where availability and sustainable management of water is ensured for all. The theme of rainwater harvesting runs throughout Goal 6, in references to water scarcity, efficiency and harvesting. RWH is a practical, cost-effective, and sustainable solution to many of the issues surrounding water management in Bangladesh, and can not only mitigate water scarcity, but contribute to increased resilience against climate change, reducing waterlogging, and restoring water-related ecosystems. The 3rd Rainwater Convention continues our efforts to work with sector actors, policymakers, practitioners and researchers to increase knowledge and use of this vital practice, towards the vision of a country that has achieved Global Goal 6 with everyone, everywhere accessing safe and sustainably managed water.

On behalf of WaterAid, ITN-BUET, CSE and RAiN Forum

Dr Md Khairul Islam
Country Director
WaterAid Bangladesh

profile of chief guest

Md Shahid Ullah Khandaker
Secretary,
Ministry of Housing and Public Works (MoHPW), Bangladesh

Mr Shahid Ullah Khandaker is the Secretary of Ministry of Housing and Public Works of the Government of Bangladesh. He worked as Assistant Commissioner, Upazila Magistrate, Cognizance Magistrate, Deputy Collector, Revenue Deputy Collector and Thana Executive Officer in the early stages of his career. Mr Khandaker was promoted as the Acting Secretary of Implementation, Monitoring and Evaluation Department of Planning Ministry during January 2016 and later on he was promoted as the Secretary of the Government of People's Republic of Bangladesh of the same ministry. He also worked as Secretary at the Ministry of Textile and Jute during February 2016 before joining the Ministry of Housing and Public Works on March 2016.

Apart from his government service, he is engaged with many social organisations. Mr Khandaker is the President of Lion's Club of Dhaka Down Town Club for last three years, consecutively elected. He is also involved in Gopalganj District Society as Treasurer and as the member of the Executive committee of Faridpur Service- Holder Society. Through these organisations he is continuing in many development works in education and social sector of his district Gopalganj and Dhaka.

profile of keynote speaker

Sunita Narain,
Director General,
Centre for Science and Environment, India

Dr Sunita Narain has been with the Centre for Science and Environment since 1982. In her years at the Centre she has worked both to analyse and study the relationship between environment, development and to create public consciousness about the Green concept for sustainable development. She is also the editor of the fortnightly magazine, Down To Earth.

She is a writer and environmentalist, who uses knowledge for change. In 2005 she was awarded the Padma Shri by the Government of India. She has also received the World Water Prize for work on rainwater harvesting and for its policy influence in building paradigms for community based water management. In 2005, she also chaired the Tiger Task Force at the direction of the Prime Minister, to evolve an action plan for conservation in the country after the loss of tigers in Sariska.

In 2012, she has authored the 7th State of India's Environment Reports, Excreta Matters, which presents a comprehensive analysis of urban India's water and pollution challenges.

Her research interests range from global democracy, with a special focus on climate change to the need for local democracy where she has worked on forest-related resource management and water issues. She also received the IAMCR Climate Change Communication Research in Action Award in 2016. She serves on the boards of different organisations and on governmental committees and has spoken at many forums across the world on issues of her concern and expertise.

In 2016, she was named to Time Magazine's list of 100 Most Influential People.

profile of special guest

Johan Frisell
Ambassador,
Embassy of Sweden in Bangladesh

Mr Johan Frisell has been in the Swedish diplomatic service since 1994. He has been posted to St Petersburg (Russia) and Nairobi (Kenya). He served as Deputy Representative to the European Union Political and Security Committee during his posting to the Swedish Permanent Representation to the European Union in Brussels (Belgium).

In Stockholm, he has worked at the Western Balkans division of the Eastern Europe and Central Asia Department. He was head of division twice; at the European Security and Defence Policy division and Eastern Europe division respectively.

He has worked in the foreign policy bureau of the Prime Minister as well.

Between 2010-2014, Mr Frisell served as director and deputy head of the Security Policy Department at the Ministry for Foreign Affairs of Sweden.

extended abstracts

rainwater harvesting in real estate sector in Bangladesh

Toufiq M Seraj

Rainwater harvesting systems in buildings has been proposed as a viable solution to the severe water crisis in Dhaka city. The water supply of Dhaka has not been able to keep up with the rapid urbanization and population growth of the city and the current water deficit stands at 500 million liters per day. Currently, 87% of the water supply in Dhaka comes from groundwater sources due to industrial contamination of the rivers. However, this poses a problem as the groundwater level is decreasing at an approximate rate of three meters every year, and various studies indicate that the ground water level is more than 50 m below the surface level. In stark contrast to the water shortage from groundwater sources, Dhaka has abundant rainfall with a 100 year average of 2290 mm. In fact, research conducted at Institute of Water Modeling in Bangladesh estimates that the amount of rainfall in Dhaka is sufficient to cover about 15% of the water supply needs of the city. Additionally, other than public consumption, water from rainwater harvesting systems can also be used to recharge the groundwater sources and prevent water clogging in the city.

While the concept of rainwater harvesting in Bangladesh has some obvious benefits, there are still many barriers to its implementation, especially when undertaken by private organizations such as real estate developers or construction companies. The first major problem is a lack of specific guidelines in the Bangladeshi building codes regarding what constitutes a proper rain water harvesting system. For example, environmental regulations may specify that certain buildings require rainwater harvesting systems, but will not give any other regulations regarding the use of the collected rainwater or the amount of storage. This ties into the second biggest barrier to the implementation of rainwater harvesting in Dhaka, and that is a lack of storage space for the collected rainwater. In order for rain water harvesting to be a reliable water supply for the community, it should also be operable during the dry season. While there is enough rainfall in Dhaka to cover for the dry season, finding adequate storage space becomes the limiting factor in a city where land is precious and scarce. In fact, finding adequate storage was one of the biggest challenges that Sheltech (Pvt.) Ltd faced while designing the rainwater harvesting system at Sheltech Bithika, a large scale project featuring 184 apartments and 12,000 square feet of commercial space. The initial cost for constructing

the storage space can also become a limiting factor. As such, without a proper incentive from the government, it is unlikely that rainwater harvesting will become mainstream, especially for private companies that usually try to minimize costs and maximize profits.

Another considerable barrier to overcome is tackling consumer's attitudes towards the maintenance of common equipment in apartment complexes. In its 28 years of service in the real estate industry, Sheltech (Pvt.) Ltd. has observed that housing societies become negligent regarding general maintenance of common electro-mechanical equipment. Although the maintenance of rainwater harvesting systems are fairly simple, a lack of maintenance can lead to mosquito and insect breeding, as well as biological growth of fauna in the collection and storage tanks, which will eventually will degrade the quality of the rainwater. Not only that, data analyzed from client feedback has shown that often clients have reservations regarding the use of rainwater at homes. So along with proper specifications in building codes, we also need training and educational tools to change the general perception of the usefulness of rain water harvesting systems among the residents of Dhaka city.

There is a saying that "Knowledge without implementation is but mere information." With that in mind, the paper presented here focuses on the challenges of a rainwater harvesting system, so that it can be successfully and practically implemented to solve Dhaka's water crisis.

promotion of rainwater harvesting by WaterAid Bangladesh: a journey since 2010

Arjen Naafs, Md Liakath Ali, Md Tahmidul Islam

WaterAid Bangladesh (WAB) has been working on urban rainwater harvesting (URWH) since 2010 with technical support from Centre for Science and Environment (CSE). As per partnership agreement between CSE and WAB, CSE is to conduct training for skill enhancement; provide technical advice and support for implementing projects related to rain water harvesting; offer knowledge support for preparing manuals, curriculum development for universities/colleges, setting up of rain centers, contribute in arranging workshops, etc. This paper has included an impact assessment with a set of notion of indicators of way forward of its endeavors on promotion of rainwater harvesting since 2010 to 2015. A research team was employed through a consultant to assess the impact of rainwater harvesting promotion initiative and this abstract has been adapted from the final report of that assessment.

Both quantitative and qualitative approaches were applied to collect primary data and secondary data analysis was done on sector documents. About 1/3rd of the total alumni's of rainwater harvesting training participated in the questionnaire survey. Moreover, the research team conducted key informant interview (KII). The team interviewed members of Rain Forum, university teachers and staff, public officials, NGO personnel, and officials of CSE through Skype, and visited knowledge center, rain water harvesting plants and others.

Under the initiative, 142 alumni from different professions (public officials, university teachers, and persons from business, NGO staff and others) got four days training on URWH conducted by CSE and organized by WAB from 2010 to 2014. Among the survey respondents most of the respondents remarked that the training enhanced their knowledge, clarified perception and provided good understanding about URWH. In general higher number of respondents rated training contents, materials and quality, technical knowledge, application scope, etc. as good.

Many of the alumni mentioned that they used training learning for awareness raising, research purposes (either themselves or helping students under their guidance for thesis writing), academic purposes i.e. taking classes on the issues or taking sessions in training program (like some of the university teachers mentioned that they take one or two sessions on rain water harvesting as part of ongoing courses, and advise students for thesis writing on the issue),

curriculum development initiative, distribute training materials, demonstration project on rain water harvesting, contribute in policy decision, supporting others in designing rain water harvesting and provide technical support on the issue, etc. As such majority of the respondents found the training useful like 48% commented that training was very useful and 44% told of quite useful.

Rain Forum is a voluntary platform and membership initiative managed by participants of URWH training for replication of the idea. The forum aims to work for capacity building, develop scopes and techniques of rainwater harvesting, promote application rainwater for domestic purposes, assist in organizing seminars, meetings, conferences, and provide consultancy services on rainwater harvesting, support different stakeholders in installing rainwater harvesting system, conduct research on relevant issues, publish books, magazines, etc.

In the past forum members have supported several initiatives of URWH like organizing training, workshop, discussion meeting, rain day celebration, publication, consultancy services, etc. Among training participants two-third of the respondents are its members. Due to its limited initiatives, one third of the members make time for different programs of the Forum. As such, 46% opted to be in the middle position regarding its performance like neither satisfied nor dissatisfied, while close to one third of the respondents commented that they are happy with Forum's activities.

Five universities were supported to establish 'rain center' to facilitate teachers and students for conducting research on URWH. The research team has a mixed experience about the utilization of the facilities amenities provided as support. It was found that the students prefer to consult the teachers instead of looking for materials in the computer or books. It seems that more time is needed for the facilities to be really successful.

Four demonstration plants for rain water harvesting were installed for promotion of rain water use, replication, etc. Three plants that the team visited use rainwater for different purposes like floor cleaning or toilet washing, or hand washing only or washing, bathing, cleaning, toilet use, etc.; other than that all the plants have rainwater discharging facilities. Regarding rainwater use, it seems there are different opinions like some recommend that it should be used only for cleaning and toilet flushing (and there should not be any human contact like washing mouth); on the other hand, there evidence that people claim that they use rain water for all purposes apart from drinking. There are also debates about at what level the rain water can be discharged and does the rain water reaches to the level from where we get underground water in Dhaka City pumped by WASA or if it reaches whether it is safe for use.

Inclusion of rainwater harvesting in the Bangladesh National Building Code (BNBC) (draft) is a result of the initiative from WAB. The code has a chapter that specifies rainwater harvesting requirements, application and approval process, roof top rainwater harvesting system including catchments area, storage, treatment of rainwater, ground water recharging, and design, installation and maintenance of rain water drainage systems. The policy needs to be finalized and guidelines prepared like installation of the harvesting plant public or private building, old or new building, use of the water, training of people like plumbers (who can handle installation of the system), cost-effectiveness, benefit of rain water use including environmental one, motivational factors for individual house owner to go for the option, role of private real estate developers, respective government departments and others.

Majority of training participants remarked that WAB is successful in its interventions for URWH promotion. For reaching the message and benefits to wider population or beneficiaries, WAB may need to consider following issues in its future course of action:

1. Network and lobby for approval of BNBC code and its implementation and monitoring mechanism;
2. Come up with appropriate design of rainwater harvesting for different types of building, costing, technical support, repair and maintenance assistance availability, etc.;
3. Conduct research about technological details and safety issues of artificial recharging of rainwater into the ground, and work on rainwater recharging system in fly-over, foot over bridge, airport buildings, rail stations, highways, stadium and feasible open areas;
4. Take measures so that Rain Forum has got formal entity with specific mandate, organization structure, office space, personnel, activities, etc.;
5. Involve private sector, real estate companies, private construction firm and others with the initiative;
6. Prepare training module on URWH and organize tailor-made training courses for different groups of people; identify relevant stakeholders in the area and share responsibilities among them;
7. Get media involved with the initiative and play a role in popularizing URWH; publish and distribute leaflet, sticker, poster, brochure, etc. for common understanding and motivation for rainwater harvesting and artificial recharging, etc.

Information from different sources and discussion with diverse stakeholders reveal that URWH is a well-timed and important initiative for water scarcity urban areas like Dhaka City. Past few years activities about URWH started by WAB have enhanced knowledge, skill and motivation on the issue among academician, professional (private, public and not-for profit), provided scope for experimentation of rain water harvesting, use, discharging and others, and policy framework for URWH promotion. It is hoped the lessons learned from the pilot schemes would guide different stakeholders to adopt rainwater harvesting in the development process.

Acknowledgement

The authors acknowledge the support by Management Consultancy Services Limited to conduct such in-depth research on promotion of rainwater harvesting initiatives.

ultraviolet disinfection for rainwater harvesting systems

Kabir Uddin Sikder and Muhammad Ashraf Ali

In small water supply systems (e.g., rainwater harvesting), disinfection is a challenge since a family or small communities often do not have necessary facilities to disinfect water properly. Also many commercially available household-level treatment systems are not very effective in removing pathogens. UV disinfection is effective against Cryptosporidium, which is resistant to commonly used disinfectants like chlorine and has the ability to inactivate pathogenic microorganisms without forming regulated disinfection byproducts (DBPs). Some recent research works suggest that UV disinfection could be effective for disinfection of water in RWH systems; however, there is no systematic data for assessing effectiveness of UV disinfection. The main objective of the present study was to evaluate the effectiveness of UV disinfection for rainwater harvesting systems. A range of laboratory experiments have been carried out in cylindrical water tanks (15L and 60L capacity), commonly used for storage of rainwater, particularly focusing on the effects of important operational (e.g., intensity of lamp, exposure time, distance/location) and water quality parameters (e.g., initial FC concentration, turbidity, color, pH) on UV disinfection. The effectiveness of disinfection was evaluated in terms of reduction in fecal coliform (FC) concentration in treated water.

The effectiveness of UV disinfection carried out in a tank/container has been found to depend on a number of operational factors including intensity of lamp, exposure time, and position/distance of a particular point (within the tank) with respect to the lamp. UV disinfection is least effective for areas (within the tank) located below the tip of the UV lamp. Initial FC concentration, Turbidity and Color have been found to affect disinfection efficiency. Turbidity of water to be disinfected should be below 5 NTU, and Color intensity should be below 50 Pt Co. While lower initial FC concentrations are preferable, if other conditions/ criteria (discussed below) could be fulfilled, initial FC concentration is probably not a major concern.

For effective design and operation of UV disinfection for rainwater harvesting systems: (1) Rainwater tank should preferably be cylindrical and position of UV lamp in the water tank should be atthe center. Height of storage tank should approximately be the same as effective length of the UV lamp; (2) The UV lamp(s) should be selected such that the entire height of water column within the tank

is covered by the length of the lamp; (3) Treated water collection port should be located at a position perpendicular to the UV lamp, few centimeters above the bottom of the tank; (4) If the above criteria could be fulfilled, an exposure time of about 30 minutes should be enough for effective disinfection of a particular volume of water (i.e. reducing FC to zero level in the treated water); and (5) Disinfected water should be consumed within 6 to 8 hr to avoid the photo reactivation or dark repair. More study is needed to better understand the effects of water initial FC concentration, Turbidity and Color on the effectiveness of UV disinfection in rainwater systems.

legal framework, policy, strategy and challenges of rainwater harvesting in India

Mahreen Matto

With rapid urbanisation and larger areas coming under roofs and concrete structures, the natural recharge to groundwater in India has drastically reduced. Moreover, an increase in demand for water has led to sourcing water from further and further away. For example, capital city of India, New Delhi is dependent on 305 km away water source of Tehri Dam (Bhagirathi River, Uttarakhand). Today almost all cities and towns of India are exerting pressure on water resources leading to increasing water demand and supply gap. Thus, there is a need to adopt an integrated approach of sustainable water management for urban areas.

The annual rainfall over India is 1.170mm which is higher than the global average of 800mm but occurs for short period with high intensity, leading to fast flow away without recharging the ground. Thus it is time to utilize the highest potential of rainwater, channelising and holding rain water to the maximum through rainwater harvesting (RWH).

India has a history of traditional RWH system implementation. Hence, the attempt should be to combine traditional wisdom with modern engineering techniques including the development of advanced urban planning and design concepts to recommend potential RWH strategies in developing areas of India.

In recent years, the government policies and strategies do talk about decentralized water management. Some of the states over last decade have focused on making RWH systems as part of their mandatory policies. The best example of RWH implemented in India is of Chennai which made RWH mandatory for all buildings (public and private) and had a tremendous impact in recharging the groundwater table all over Tamil Nadu. The average ground water level has increased from 6.8m in 1987 to 4.87m in 2012.

However, there is a scope and opportunity for all the new developments and planned areas to integrate such design of the urban water cycle through RWH system as part of their state/city level policies. Thus it is high time that government agencies of the cities make deliberate efforts in making water every body's business and work prudently towards implementation of RWH in the area.

prospects of Managed Aquifer Recharge as a tool for improving groundwater quality and augmenting quantity: lessons learned from the UNICEF-DPHE-AWN-DU project

Kazi Matin Ahmed

Introduction

The coalition of UNICEF Bangladesh, Department of Public Health Engineering (DPHE), Acacia Water Netherlands (AWN) and Department of Geology, University of Dhaka (DU) initiated a project in 2009 to assess the applicability of managed aquifer recharge (MAR) to improve groundwater quality and augment quantity in Bangladesh. The work started with a national scale GIS mapping to identify the areas having scopes for applications of MAR. The map identified different areas with varying scopes for MAR application. Limited field experiments were undertaken in coastal areas of Khulna, Satkhira and Bagerhat Districts in 2010 with the objectives to build low cost, disaster resilient, year round potable water supplies for communities living in areas with severe water scarcity due mainly to salinity.

Field Testing Results

Field experimentations started with building 20 MAR sites in three phases in order to assess the effectiveness of various designs in improving water quality in terms of salinity, iron, arsenic and pathogenic microorganisms. Recharge through injection well was adopted due to presence of top clay layer above the target aquifer over most of the study area. Systematic site selection survey is conducted to prepare site-specific design of the managed aquifer recharge (MAR) systems. Various types of over-, above- and under-ground recharge systems were built with varying number and diameter of recharge wells using pond and rooftop rainwater as source water. All locally available materials have been used and systems were constructed by employing local drillers and masons, costs varied from 300,000 to 600,000 BD Taka depending on the site specific design. Systematic monitoring of various water quality and quantity parameters was carried out at all sites. Groundwater salinity decreased from more than 15,000 uS/cm to less than 2000 uS/cm at most sites; arsenic and iron also decreased at all sites; microbiological water quality was also within acceptable limits. Amount of infiltration and recovery efficiency varied from site to site. Communities have been allowed to collect drinking water from 19 out of 20 sites; one site has been abandoned due to very high salinity of ambient groundwater and lack of suitable source of recharge water. Partnership has been made with local NGOs and communities for operation, monitoring and maintenance of MAR sites.

Limited Upscaling in Coastal Areas

Having inspired by the success of field testing, a limited up scaling plan for construction of 75 MAR sites in 13 Upazilas of three coastal districts of Khulna region was initiated. Site selections has been based on questionnaire survey, reconnaissance visits, exploratory drilling, installation of test wells, and analysis of water samples. Final site selection was made after assessment of criterion like existing safe water sources, availability of source water, willingness of the community to pay for operation and monitoring and subsurface suitability in terms of existence of aquifer at shallower depth and ambient water quality. Based on field testing one prototype design was adopted which was modified at each locations as per field conditions. Sites have been constructed through DPHE tendering and put into operation since August-September last year at costs of 600,000 to 700,000 BD Taka. Social mobilization has been carried out in order to ensure sustainable OM&M of sites for providing water supply during dry season and also at times of disasters by developing site specific management models and water safety plans.

Piloting in Urban Areas

Applications of MAR to augment water quantities in depleting aquifers of Dhaka City has also been undertaken. A satellite imaged based assessment of the Dhaka University campus was undertaken to identify potential areas. Three different conceptual designs based on rooftop rain and pond water was prepared. However, two different types were tested at two locations in the campus. One site has been built at the Sergent Zohurul Hoque Hall area where rooftop water is infiltrated through two recharge wells drilled to a depth of 100feet. Provisions have also been made for gravity infiltration of pond water. However, pond water infiltration was not tested as the proposed source pond was used for fish culture using various chemical fish feeds. A recharge well has been installed at the bottom of the dry pond inside the Institute of Fine Arts. Two infiltration wells have been installed at each site, one deeper one below the current water level in the Upper Dupi Tila Aquifer and one at shallower depth in the middle depth of the screened part of the recharge well. Regular monitoring of water level, amount of infiltration, electrical conductivity and rainfall has been carried out.

Investigations in Drought Prone, Peri-urban and Arsenic Affected Areas

Investigations have been conducted in drought prone areas of northwest Bangladesh where the static water level declines below the suction limit of number six hand pumps. The investigations aimed at assessing the potentiality of applications of MAR to augment groundwater storage. Investigations have also been conducted in periurban areas of Khulna City Corporation to improve quality of water in localized areas where fresh groundwater is not available. Effectiveness of MAR has also been assessed in an arsenic prone area to lower concentrations to acceptable limit.

Lessons Learned

MAR can be applied under various different conditions either to improve water quality or to augment groundwater storage. Proper design as per systematic site selection investigation is important in ensuring successful applications. Low cost MAR systems can be constructed using local materials by employing local drillers and masons to provide safe water round the year and at times of disasters at a competitive cost. If properly managed, MAR can provide adequate quantities of water within acceptable physical, chemical and microbiological quality parameters. Systematic monitoring of key parameters like quantity and quality of water is essential is ensuring sustainable operations of MAR systems. Local communities can be mobilized and trained to undertake OM&M of MAR systems under proper institutional arrangements. Initially, investments from government and non-government agencies are needed in targeting difficult areas where other technologies are not available at affordable costs. National guideline on MAR application along with OM&M manuals need to be prepared for adopting this as a tool for water management.

setting an enabling environment for rainwater harvesting

Arnoud Keizer, Robert Meerman

Introduction

Rainwater Harvesting (RWH) is often overlooked as source of water supply. However, it holds great potential to address water supply and ever increasing water shortages globally. The huge potential of RWH for multiple use such as food production, soil and water conservation and WASH has not been adequately recognized and certainly not implemented or seen yet as a solution for water problems at a wider and larger scale

With the IFAD financed program called rain4food, we set an enabling environment for rainwater harvesting (RWH), in order to significantly increase food security. With help of our virtual community on Rainwater Harvesting, we support the development of a more unified global network of national and regional organizations, networks and professionals, working in or interested in rainwater harvesting. By bringing together these key-actors and sharing knowledge in multiple ways, the programme aims to achieve sustainable change in rainwater harvesting programmes. Its main objectives and activities are:

1. To bring together a diversity of rainwater harvesting actors.
2. To support global, regional and national exchange of knowledge about rainwater harvesting.
3. To provide tools and lessons learned from the field.

This network will add value to RWH practitioners, experts, policy makers and scientists, as the network focuses on sharing best practices on the use of rain water for food production, fitting well in the theme best practices on RWH, as well as technical options and innovations.

Who does the programme benefit?

As this programme is aimed at creating an enabling environment for RWH, the primary target groups are national and regional RWH networks, water related (development) organizations, public sector and professionals in the (rain) water sector. Secondary target group are large implementation agencies and national governments (policies, plans and budgets). IFAD projects in the proposed countries are additional target groups.

Benefits are strengthened RWH networks and capacities in the Horn of Africa, West Africa and Latin America, as well as on a global level.

Key results

Major achievements under objective 1 (bringing together a diversity of rainwater harvesting actors) are

- A 2015 conference in Ethiopia has led to multiple parties including World Vision, FAO, IWMI and SEI signing a declaration on the importance of RWH.
- Based on demands from IFAD Uganda, and in close collaboration with strategic partners, the roads for water initiative started.
- A 2014 conference in Uganda has led to signing an agreement with the Ministry on replicating the (catchment management) methods used as presented in two other catchments in Uganda, as well as a new program funded by implementing partner GIZ that is based on this approach.
- Large implementing organizations like Red Cross and CARE have embraced the 3R/water buffering/rainwater harvesting approach in their global Partners for Resilience program.
- A solid network has been created between existing rainwater harvesting networks, ambassadors and (international) organizations, which is reflected in a Community of Practice (CoP) of more than 800 members that links knowledge.

Major achievements under objective 2 (support global, regional and national exchange of knowledge about rainwater harvesting) are

- The CoP is an important foundation under the continuation and future growth of a global RWH network for which the webinar series proved very important.
- Strategic partners like RWSN embraced RWH as a strategic theme within their organization and this is coming back as a separate topic during the next forum towards the end of 2016.
- The uptake of RWH amongst implementing organizations has been promoted by spreading modules, almost 200 publications, guidelines (most were repackaged) and other relevant documentation through mass- (social) media and target marketing.
- Creating one interactive online platform which offers different sources of information, contributed significantly to knowledge transfer and networking. In total 64,348 RWH Wiki visitors and 94,461 RWH Wiki page views, prove that this section is quite popular amongst our target groups.

Major achievements under objective 3 (provide tools and lessons learned from the field) are

- Effective knowledge transfer - on the job training - has capacitated hundreds of professionals, (future) decision makers and students with the theme of rainwater harvesting in relation to climate change, food security, resilience and multiple use.
- Educational institutes like Unesco-IHE and CapNet have integrated the topic of RWH in their curricula.
- Translations have been made of existing documents into French and Spanish, thereby meeting demands of users, decision makers and practioners in the West-Africa and LAC region.

Conclusions

The technical backbone of this programme, which is the development of a multi-media platform with all its functionalities, has been key to supporting the activities. 12 partner organizations and 11 ambassadors from various regions in the world were engaged in supporting knowledge sharing and wide-spreading of RWH. This led amongst others to exchange visits with RWH networks in Brazil, Ethiopia, Uganda and Senegal that targeted policy influencing and stimulate learning by doing.

Also, series of webinars were organized bi-monthly on RWH for food security in which various experts and other stakeholders presented how they saw the importance of RWH linked with various thematic issues. Also, a variety of tools were created, such as a GIS tool, a RWH decision support tool and an environmental assessment tool, that helps implementers, decision makers and other interested organizations to integrate 3R, MUS and sustainable finance into their programmes and projects.

An important lesson learned is that these initiatives need to be replicated with active movements on a local/regional level, e.g. in Bangladesh, and that capacity building and promotional activities with regards to RWH should be integral part of regular programs.

profile of presenters

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Dr Toufiq M Seraj is the Founding Managing Director of Sheltech (Pvt.) Ltd. and its associated companies. He is an Engineer and Planner by profession. He obtained his Ph.D. in Civic Design from the University of Liverpool, UK as a commonwealth Scholar. Earlier he completed his Master and Bachelor degree from BUET. He formerly held academic positions at BUET. He has extensive professional experience in Real Estate Development, Construction, Management and Planning Consultancy. He has wide range of publications including several books on Town Planning, Housing and Real Estate.

Besides Real Estate he is also involved in other businesses which include Consultancy, Hospitality Industry, Construction of Industrial Buildings, Manufacturing of Concrete Products and Ceramic Tiles.

He is the former President of Bangladesh Institute of Planners (BIP). He was the President of Real Estate & Housing Association of Bangladesh (REHAB) for three consecutive terms. He formerly held leadership positions in several professional and social organizations. He is also actively involved in different research and non-profit organizations.

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Arjen Naafs is a Dutch by national with MSc in hydrogeology (Free University Amsterdam), and is passionate about water security, sustainability and mapping and have more that fifteen years' experience in WASH sector. Prior to joining WaterAid, he has been the country coordinator and leading researcher of the WASHCost initiative (led by IRC), and the founding partner of WE Consult, Mozambique. He has research publications on the costs for providing sustainable services for the rural and peri-urban poor, on sustainability and monitoring and on hydrogeology. Mr Naafs's technical focus is on Resilient WASH, sustainability, groundwater recharge, urban approaches, costing analysis and surveys.

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Dr Muhammad Ashraf Ali is a Professor of Civil Engineering at Bangladesh University of Engineering and Technology (BUET). Dr Ali also serves as the Director of International Training Network Center (ITN-BUET). The main focus of his research and teaching is on water quality engineering, sanitation, and air quality. His current research is focused on disinfection of potable water, removal of arsenic and manganese from potable as well as irrigation water, water safety, and fecal sludge management (FSM). He was involved in the development of the institutional and regulatory framework for FSM, and national action plan for reduction of short lived climate pollutants (SLCPs).

Dr Ali has been providing expert services in a number of major projects of national interest, including the Hatirjheel project, Dhaka Elevated Expressway Project, Dasherkandi Sewage Treatment Plant, EIA of Siddhirganj Power Plant, Saidabad Water Treatment Plant of DWAWSA, Karnaphuli Container Terminal (KCT) and Patenga Container Terminal (PCT) of Chittagong Port Authority, and Municipal Governance and Services Project of LGED. He is Life Fellow of the Institution of Engineers Bangladesh (IEB).

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Dr Matto is doctorate in Environmental Biotechnology from Aligarh Muslim University, India; her area of research was on 'Cost Effective and Affordable means of Treating Industrial Wastewater by Enzymes'. She has credit of publishing 9 international research articles in the area of water/waste water management in reputed journals. She has been extensively working in the area of water, waste water and faecal sludge management with CSE, India. In CSE, she has contributed in the publication of reports and manuals on Rainwater Harvesting, Decentralised Wastewater Treatment and Reuse, City Sanitation Plan-Trainers manual and City Sanitation Plan-Practitioner guide. She is also been preparing modules and conducting trainings of various stakeholders across India, Bangladesh and Africa on sustainable water management.

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Prof Dr Kazi Matin Ahmed is the current Chairman of Department of Geology, University of Dhaka and a leading researcher on groundwater in Bangladesh with focuses on arsenic, salinity and urban and irrigation water management. He completed his BSc (Honours) and MSc degrees in Geology from University of Dhaka; and PhD in Hydrogeology from University College London. He has been involved in research on groundwater in collaboration with National and International Institutions. His current research includes applications of Managed Aquifer Recharge in the Coastal Aquifers of Bangladesh for increasing water access in collaboration with the Acacia Water, UNICEF Bangladesh and Department of Public Health Engineering; Delta-MAR with University of Utrecht and Technical University of Delft, Netherlands; Underground Taming of Flood for Irrigation with IWMI; Sustainability of Groundwater Irrigation and Food Security in the Barind Tract, Bangladesh with University College London; Health Impacts of Salinity with Imperial College London and Geochemistry and Health Effects of Arsenic with Columbia University, USA. He has contributed to more than 220 journal papers, book chapters and conference proceedings with about 7000 citations. He is member of various professional societies, has organized National and International conferences on groundwater and presented invited/keynote papers at home and abroad.

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Arnoud Keizer is a civil engineer and has a master degree in water management. Previously he worked for seven years for Royal HaskoningDHV as a project manager/ engineer specializing in river basin management and hydrology. He has expertise on agricultural water management (including irrigation), climate smart interventions, such as water retention, re-charge and re-use (3R) technologies, flood and drought assessments and river restoration. For Aidenvironment\RAIN he performs applied research on water balance analyses, including climate change and socio-economic scenarios, advising clients (NGO's, companies and governments) how to achieve environmental sustainable and efficient use of available water resources. He has working experience in several Asian countries (like Nepal, Bangladesh, Indonesia, Philippines and Vietnam). He often uses GIS maps to communicate project results on catchment level.

It is estimated that if 60%
rainfall from roof top in Dhaka City
can be harvested, then about
200 MLD can be made available

approximately 15%
of the **ANNUAL DEMAND**
of Dhaka City can be met from
HARVESTED RAINWATER

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