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Bangladesh, Factor 2: Water Scarcity

Bangladesh: Smart water usage, water recycling, and rainwater usage to tackle groundwater level declination

Introduction:

Bangladesh, the land of rivers. Since the birth of this although very small territory, it has been blessed with 700 rivers and also plenty of other water bodies and a huge stock of ground water. But sadly, in recent times the ferocious paws of urbanization and population growth outburst have been impeding the advantages of Bangladeshis with so many natural resources.

Bangladesh is very quickly running down with pure drinking water in recent times. That's mainly because of population growth annually at an alarming rate around 1.4 (per 1000), creating more pressure on the fixed amount of water resources as more people are sharing them. It seemed that surface sources are not enough for them. So they started setting up tube-wells here and there. But still, the population grew denser day by day. Thus, groundwater has been being overused since the last 3 decades, especially during the last two.

In urban areas, water usage classification is as follows:

- 32% piped (comes from purified river or surface water)
- 68% tube wells

In rural areas the breakdown is:

- Less than 0.6% piped
- 96% tube wells
- 1% dug wells
- More than 2% ponds, lakes and rivers

Mysteriously, but although after starting to use groundwater so much, the problems are still not solved. A large section of people are still not getting enough water to lead their daily lives. Especially in remote rural areas and urban slum and relatively less developed areas, they are walking miles and miles away to collect water, or surviving without it; unhealthily, and with insufficient water to consume. On the other hand, groundwater is getting so low, that Arsenic contamination has started in many places. It gradually emerged that 70 million people drank water which exceeds the WHO guidelines of 10 microgram of arsenic per litre, and 30 million drank water containing more than the Bangladesh National Standard of 50 microgram per litre, leading to chronic arsenic poisoning. Also the whole country is threatened from greater earthquake damages as the soil content is getting void, with the water being sucked up. Then what

is creating all these problems? What are the solutions to it? For that it is necessary to look up the socio-economic background of mass Bangladeshi community, and also the family status.

Factors Behind Water Scarcity: Family structure and facts; Underdeveloped communities facts (both urban and rural); and the Obstacles

As mentioned earlier, Bangladesh has a high population with respect to its resources. So the life standard of a large section people is not satisfactory. This section don't have proper knowledge to choose the optimum ways and take the smarter and efficient decision to solve the scarcity regarding problems. A lot of it is due to the family condition here. It is explained below:

A typical Bangladeshi family both in rural and poor urban areas consist of the parents and 2-3 children or sometimes, 4-5 children. But sometimes, there exists joint families with the uncles, aunts and grandparents, making a family ranged between 5-10 members. The women are engaged in heavy physical activities both in case of assisting in farming or doing household chores and bringing up children. Still some women work outside home to earn money, from this community.

Their diet consists of mainly rice and vegetables or gravy filled curries, being boiled. So plenty of water is used in cooking. But as far their affording, they are mainly dependent on lunch and dinner, this, not having nutritious breakfast, or sometimes no breakfast at all. Although, that is very crucial for proper nutrition for children and women. And so, malnutrition is a great issue here. These families both in sub-urban and farm areas, live on by purchasing groceries, and food from local markets (rarely includes food readymade from any restaurant or road side store, as it may find expensive) . It's because of the low income rate. Farmers earn on average, 70-110 \$ monthly. Middle low class urban families do it about 120-180\$. The problem in case of farmers would have been irrelevant, if all their nutrition supply came from own crops and animals. But most farmers actually are employees in others' farms or land, they don't own them. This ownership scenario is changing gradually though. In comparison

Most of Bangladesh's laborers are engaged in informal, low-income jobs with limited productivity. Although agriculture now accounts for less than 20 per cent of GDP, the farm sector still employs about 44 per cent of the labor force. However, with urbanization, the amount of farmland is shrinking, and most rural households have very little, if any, cultivable land. Rice is the dominant crop, but production increases are limited by farmers' lack of access to critical production tools such as high-yielding rice seeds. In addition, coastal areas are prone to saline intrusion. Fisheries are also an important part of the Bangladeshi economy, providing a source of high-value protein. Yet the fishing industry remains underutilized. Poor fishers need more advanced technologies and better access to open bodies of water in order to expand production, which will improve incomes and nutrition.

Another root cause of rural poverty has been population growth, although this has dropped sharply from 3 per cent to 1.4 per cent in recent years. Population density remains extremely high, placing enormous pressure on the country's natural resources – especially on arable land. Meanwhile, rural and urban industries are unable to meet the demand for jobs, forcing many Bangladeshis to seek work abroad.

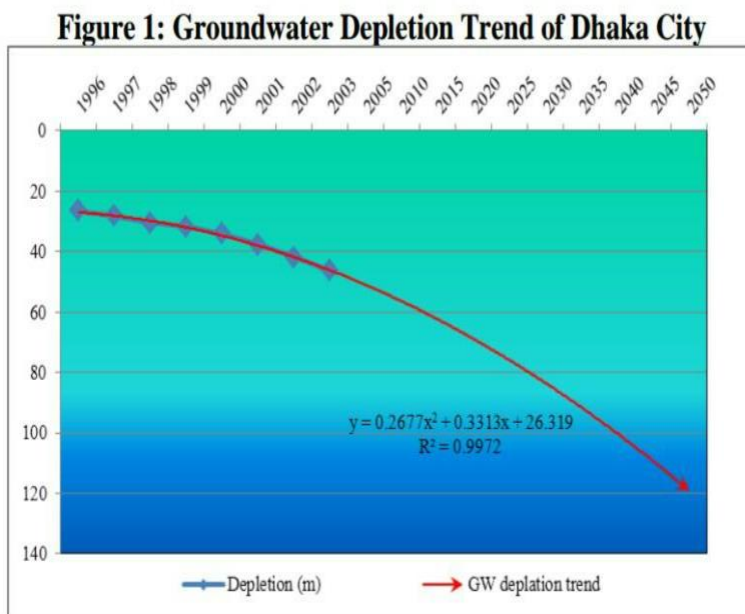
Another great obstacle here is regarding the availability of pure water, that, A poor household (whose total household monthly income is less than 10000 BDT (125 \$)) has to spend 500 BDT (67.5 \$) per month for 30 l/p/d while a middle-income or high-income group family (whose total household income is

more than 10000 BDT) has to pay 400 BDT/month (50 \$) for water supply of 45-50 l/p/d or more. Poor people have to buy additional water to maintain their daily activities. This extra spending of water hinders to improve the livelihood status of them.

These less educated or uneducated communication it are unconscious of their life. So they are struggling with contagious diseases all the year, like cholera, diarrhoea, malaria, tuberculosis, influenza, and they don't always have access to quality health care due to remote locations or shortage of money to continue treatment for long. This unhealthy life structure. This effects to environment pollution as well. Besides, unknowingly, they are polluting their surface resources. For example, without being optimal, they use their ponds or canals same water body, for the purpose of drinking, washing clothes and bathing. So they are again using the same dirty water, making the source unreliable as pure water source. Then they use the groundwater source.often, and sadly, they do a lot of wastage of water even during carrying them, not paying attention to spilling of water, or using the tube well for little washing purposes too, using too much water, for small purpose. Eventually that water is not returned to the ground source.

These all are the obstacles for them to access pure water source, and to preserve groundwater.

Effects of Water Scarcity, Groundwater level Declination and it's present situation:



Source: Authors' calculation based on Dhaka City State of Environment 2005, 2011

The trend of groundwater deficit is rapidly getting more and more critical in Bangladesh. It has already reached 60 metres below the ground the water level. Which is a lot many. And specially, the water is running out at a higher rate, unfortunately, although nobody is aware of that though. The present problems that have been created by groundwater deficit are:

- Reduction in sufficient drinking water of people. 60% people are having just three quarters of their requirements
- Lack of irrigation water during drought period, as 75% land uses groundwater. This, great loss in agro-economy
- Remaining unclean and unhealthy, without enough water to perform washing of hands, body, and clothes.
- Not enough water for sanitation. Since, most house in urban area connected by groundwater. And low quality sanitation, spreads germs and stomach ailments, making the environment more filthy to live.
- Dehydration of women and children. Especially, it is a challenge for pregnant mothers, to adjust with water deficiency. It is causing, harm to new born child and also may cause premature death in some cases.
- The production of farm based family are decreasing, and so spread of malnutrition occurs. There is not enough water for domestic animals as well.
- Mass people are compelled to use polluted river water. The extreme poisonous industrial waste mixed river water causes not only chemical poisoning, but also skin diseases, and permanent failure of liver and other body parts. Sometimes, the water contains carcinogens too. It is especially seen among sub urban inhabitants around the industrial area
- Making arsenic contamination a new threat, especially to poverty stricken people

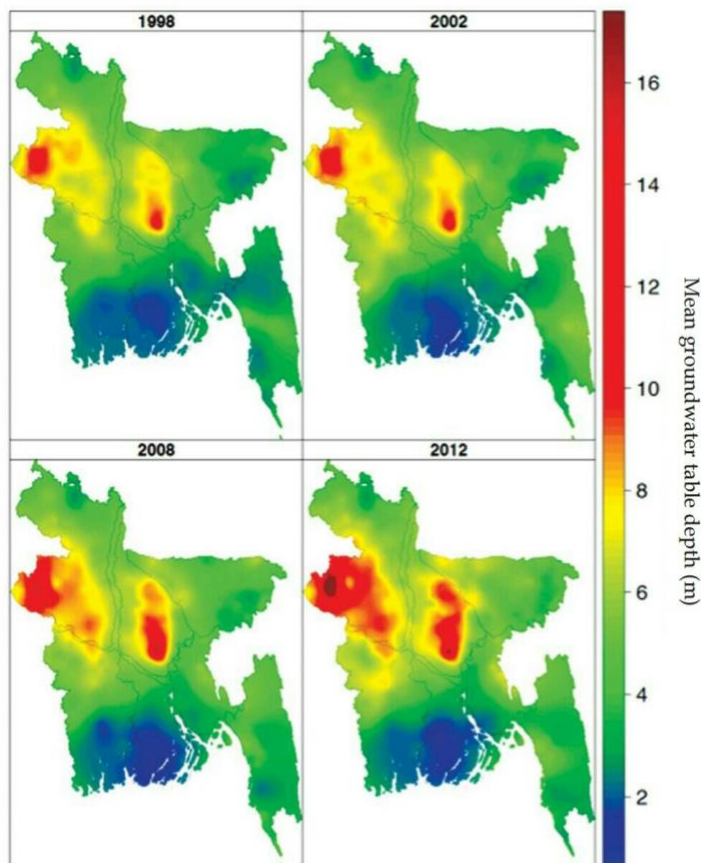


FIGURE 7.
Mean ground water table depth (m) for the height of the dry season (March, April and May). Surface maps were created using multi GussianKriging from the time series data of observed groundwater levels from the Bangladesh Water Development Board (BWDB).

This present situation in groundwater declination is very alarming. And it may grow worse, as the global warming and climate change is taking over as another great issue to all. This may damage the water cycle and recharging of groundwater even harder in the coming years, increasing the sufferings of people in the following ways:

- Irregularities in rainfall may collapse the way of aquifers to restore groundwater
- Frequent flooding, causing the mainland wastes to get mixed up with water, and later on when flood water recedes, some of the polluted water may mix with the groundwater source making it polluted, too. Especially it's crucial with us, because of the large amount unplanned waste management in many areas including large volume of open waste
- Arsenic contamination may rapidly increase.
- With climate change and lack of water, many varieties of crops may diminish.
- Taking care of domestic animals may become harder and expensive, with them falling sick frequently, without sufficient water to provide.
- Cities may become worse place for children to grow up, because of the filthiness and chance of new diseases spreading increasing.

- Climate change will cause increase in salinity in different regions, making the limited surface sources and groundwater even more limited.
- Massive effects of earthquake. Research says, 70% of Dhaka's buildings will get destroyed with a more than 7.2 magnitude earthquake, a lot because of 70 metre void space underground, which was occupied by groundwater before, making it compact.
- Death of infants and women may become more critical issue in the coming years.

Solutions to Groundwater Declination:

Master plan 1 (applicable for urban areas) : Rainwater is a very pure water source (though always not fully pure to drink) . Introducing Rainwater collection method, either, to restore groundwater (which may be expensive and so a second option project) , or, to establish it as a permanent source of water.

For that we need, large plastic vessels, with small inlets to catch rainwater - in case of vehicles. That can be set over private cars, and trucks and buses, and also launches and water vehicles (if design supports; proper consultancy with engineers is required in that case). This would give a handsome source of water starting from March to the month of October. The vessel will be emptied after every day's usage, so that it remains clean, and cheap options like alum may be used to keep the vessels purified if needed in addition.

For streets, there has to be separated outlet for rainwater, and it should not mix with the sewerage system. Of course, a precondition for this system is that strict maintenance of laws should be maintained about keeping streets absolutely clean, to prevent massive water contamination ... Also streets should be kept even as possible, to prevent stagnant water leading to insect habitat. All these pipelines to collect rainwater can be connected to the buildings nearby.

The roofs of the buildings should also have a similar system as the streets, and here too, the water will go and mix with the water supply of the houses. (the roof project is applicable for farm houses too. In this case, water is collected in a final vessel).

A sample calculation can be shown for this... during April to September, the amount of rainfall in Dhaka usually ranges around 320 mm per month. Area of Dhaka city is around 167000 square meters. So if we plan to cover even 70% area of the city, to catch rainwater, we see, multiplied by amount of rain, per month we can gain 37408 cubic meters of water per month, with a very little filtration needed. Whereas, the Saidabad Water Purification Plant has to do a hard job in purifying the massively polluted water of the Buriganga River, proving itself mostly ineffective, very poorly filtrating 45000 cubic meters water per day, though they are not applicable to drink or improved purpose. Whereas, a short hand (very less amount compared to the water purification plant, still thousand times pure) pure water source can help the people to meet everyday demand, at least to some extent. Later on, with increasing rainfall or capacity of this project, this can lead off to a better source or idea.

Master plan 2: Stopping wastage of overfilled water. The tanks in the houses fill up by a motor in urban areas. But regretfully, huge section of landlords and caretakers are careless about the time to fill up the tank, and often it is seen that the tank being overload, spilling out precious groundwater for 2-3 hours, all wasted. So the water tanks can have a ball-cock system (like in the flushes in bathrooms), which will auto close the lifting of water by the motor pump as triggered by the fulfilling of the tank. Also, the water can be taken back to the reserve tank at the bottom of the house, with a return outlet pipe. Again, a sample calculation can portray the savings made in this way.

As per my general observation, a water pump generates a flow rate about 2 cubic metre per hour. And once almost every 2 days, it is seen that some house is wasting water for 1 to 2 hours, whereas my nearby observation includes about 0.3 sq. KM. So, dividing this by total area of city, we get the number of house doing the wastage and multiplying by the lifestyle lost daily we get: $5010 \times 1.5 \times 2$ cubic metres = 15030 cubic meters in 2 days.... Or about 7500 cubic meters of groundwater at least wasted every day round the city this way. Thus, the new project will save many water.

Other Plan 1: Making separate outlet for water used in kitchen and the one in bathrooms, because, mixing all the water all up in the sewerage lines, and finally letting them mix with water of rivers, is just making purification complicated. Rather, a separate purification system for kitchen used water for a sub urban area or urban area would work better. This method can be applied for farm house, too. Because, water used in kitchen can be used for other agricultural purpose and lighter works, rather than to use a new volume of groundwater

Other Plan 2 (for farm areas) : Using separate ponds for using water for drinking and cooking and on the other hand for bathing, bathing animals, etc. Not to use area around the pond for defecation and excretion.

Existing Project:

- At private levels, there are small scale projects in coastal areas to preserve rainwater on household scale
- There are also some other projects run by organizations like World Bank and UN Inter-governmental Panel on Climate Change to give monetary assistance and technical advice to farmers, to learn optimal proportion of water usage and preserving them, for example by digging irrigation preservation canals, etc.

Conclusion and Precautions to the Problem:

This challenge for groundwater isn't to be solved in one-day. It will need step by step approach and adjustments to make the above projects fruitful. But that will need strict regulations for both public and government and external help sources to follow. These are:

Steps by people:

- Not wasting any water
- Using groundwater for specific purpose only: washing clothes and utensils, drinking, etc. trying not to use it for irrigation purposes
- Learning floating agriculture to utilize flood water in farming
- Not defecating by the water bodies
- Separate the use of ponds as per their mode. Different ones for cleaning use and consumption uses.
- Spreading education and training on water and sanitation and environmental awareness, by the well off section people, by arranging volunteering programs.

By government :

- Strict rules application on water uplifting by landlords and following fair laws. It may include, the water supply lines connected with an auto system, and to create a way of cutting of water supply as penalty, if someone wastes water, using censor.
- Patronizing projects establishing permanent rainwater preservation and reuse system, and separate purification system for kitchen water, water used in crop fields and bathroom water.

By supporting nations:

- Patronizing the project by monetary support and giving new ideas

Bibliography :

1. https://en.m.wikipedia.org/wiki/Water_supply_and_sanitation_in_Bangladesh
2. https://en.m.wikipedia.org/wiki/Improved_water_source
3. https://en.m.wikipedia.org/wiki/Economy_of_Bangladesh
4. <https://operations.ifad.org/web/rural-poverty-portal/country/home/tags/bangladesh>
5. <http://progressbangladesh.com/bangladesh-people-in-tight-spot-as-living-and-food-costs-rise/>
6. https://en.m.wikipedia.org/wiki/Climate_of_Dhaka
7. <https://www.mssanz.org.au/karim>
8. <https://ci3.googleusercontent.com/proxy/y-eEJVZO0ZxtirXuMmRjVZzxAGAwJupv74ajiF4CXmb6sur6K2QwkLXr7GMupOJtKP91SqftvjLoCJwE2ulPcY6K1RZBhXx1bEGr9pISY6roJZcq139mt0P8=s0-d-e1-ft>
9. https://ci3.googleusercontent.com/proxy/y-eEJVZO0ZxtirXuMmRjVZzxAGAwJupv74ajiF4CXmb6sur6K2QwkLXr7GMupOJtKP91SqftvjLoCJwE2ulPcY6K1RZBhXx1bEGr9pISY6roJZcq139mt0P8=s0-d-e1-ft#https://ssl.gstatic.com/docs/doclist/images/icon_10_generic_list.png