INDIGENOUS PRACTICES FOR WATER HARVESTING IN BANGLADESH

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Abstract: *This paper examines the strengths and weaknesses of indigenous and traditional water harvesting methods practiced in Bangladesh. Most of these methods are practiced in the Chittagong Hill Tracts (CHT). Commonly used methods in the CHT include Jhurjhuri, Phour, Thagalok-kum, cross dam, Ghoda and Thelya-thok. They are used to serve a variety of purposes such as household water supply, irrigation, navigation and fish culture. In plain lands, rainwater is naturally harvested in large and small depressions such as haor, baor, beel and numerous ponds. Water collected in these natural and man-made water bodies provide both direct and ecological benefits. Methods practiced by the indigenous communities however are facing the risk of displacement by modern technology (tube well, pumps) introduced by the migrant people from the plains. Moreover, water bodies in the plains are being threatened by encroachments and unplanned development activities adversely affecting the hydrologic regime. Suggestions for alleviating these problems have been put forward in this paper. Lastly, the possibility of harvesting rainwater in urban and arsenic- affected areas has been discussed.*

Introduction

Water harvesting is a method of collection and storage of rainwater that can be used to meet household, agricultural and navigational needs. As early as 4,000 years ago people of the Negev Desert in Israel stored rainwater for household and irrigation use. In Central Asian states with hot and arid climate, people harvested water in underground tunnels, which were also used to transport water to long distances. In Iran such tunnels are called Q*anat.* There are some 22,000 quanats in Iran supplying about 75% of all water used in the country (Todd, 1980). Water tanks were dug in rainfed areas of South India as early as 230 B.C. (Barah, 1996). Ancient Romans used cisterns and paved courtyards to collect rainwater to augment water from aqueducts. Water harvesting methods are still practiced by the Tohono O'odham and Hopi tribes of the southern US, who traditionally plant after the onset of summer and winter rains (TWD, 1997). Even early in this century, many cattle ranchers in the Midwest of the US used stone and steel cisterns to fetch rainwater, which was their primary water source.

Indigenous people living in the hilly areas of Bangladesh have practiced water harvesting for centuries. In a recently conducted study, as many 52 indigenous methods have been identified that are being practiced by tribal people of Bangladesh for watershed management. These methods, which are deeply rooted in the tradition and culture of the tribal people, involve activities related to water and soil conservation, agro-forestry and religious rituals (Bose et al., 1998). Although crucial for maintaining sustainability of hilly areas, these methods are currently being threatened by growing socio-economic pressure such as large-scale deforestation and relocation of hill people.

In fact, many water conservation methods practiced by flat land farmers of Bangladesh can also qualify as indigenous forms of water harvesting. Numerous ponds, *beels* and *hoars* all over the country have been used to store water in the rainy season. Some of these practices are diminishing with the introduction of mechanized irrigation and agriculture. However intensive agriculture is not sustainable in the long run and it may prove to be extremely harmful to the local ecosystems.

This paper is an outcome of a research on water harvesting methods practiced in Bangladesh. The paper will attempt to identify the current water harvesting practices along with their strengths and weaknesses and suggest ways to incorporate these methods with modern water management. Also suggestions will be made to promote water harvesting in urban areas where a significant part of the population will live in the 21st century.

Water Harvesting and Traditional Practices

Indigenous people have been harvesting rainwater for homestead gardens for centuries because water harvesting is a convenient and low-cost method. A water harvesting system may have the following components:

1. An area for harvesting rain;
2. A system of conveying water for storage;
3. Storage tank or reservoir;
4. A distribution system to deliver water to the point of use.

Unless used for drinking, no treatment of rainwater is required for household and agricultural usage. When collected for drinking purposes, water may have to be filtered to screen out floating and suspended particles.

In Bangladesh, many water harvesting methods are used in hilly and flat areas. Hilly areas are located along the northeast, east and southeast borders of the country, which include the hills of Mymensingh, Sylhet and Chittagong Hill Tracts (CHT). These hills, which make up about 15% of the total area, are

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primarily inhabited by the people of Garo, Monipuri, Khasia, Chakma, Marma and Mog tribes. The rest of the country is largely a flat flood plain inhabited by people known as *Bengalis*. *Bengali* farmers also practice various harvesting methods to conserve water for household and agricultural purposes. The next two sections provide examples of common water harvesting methods practiced in Bangladesh.

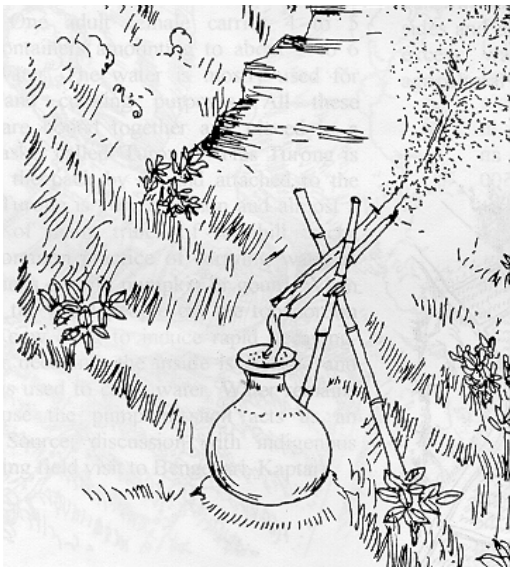

Fig. 1: *Thagalok-Kum* practiced in CHT

Harvesting in Hilly Areas

For household purposes, *Jhurjhuri*, *Phour* and *Thagalok-Kum* system are used. For irrigation purpose, indigenous cross-dam and retention ponds are used in Kaptai and Banderban. *Godha* method is used for navigation in different areas of CHT. *Thelya-Thok* is a multipurpose method also used in CHT for household, irrigation and navigation. It is believed that similar methods of water harvesting are practiced by tribal people of the northern and eastern hills.

Jhurjhuri

This is well dug in a sedimentary rock formation into which water collects through seepage. A *Jhurjhuri* is about one meter in diameter and half to one meter in depth. They are usually built at the base of a hill-slope. Water in a *Jhurjhuri* is clear due to natural filtration though soil formations. It is also cooler as the water is not exposed to the surface temperature. The knowledge about siting and building a *Jhurjhuri* is transmitted in the tribal community from one generation to the next. A *Jhurjhuri* is also a convenient meeting place for people in the locality.

Phour

This is an indigenous form of water pond, which serves a small community of families and is designed to meet all their household demands. Typical size of a *Phour* is about 7-8 m^2. Water in the pond is collected from rainfall and seepage. To prevent inflow of sediment-laden water, dyke of about a meter height is constructed surrounding the *Phour*. Trees are planted along the dyke to stabilize the banks. Indigenous fish may also be raised in a *Phour*.

Thagalok-Kum

This is a system of water harvesting specifically designed to provide drinking water to a community. To avoid traveling long distances, water is fetched at the end of a small natural stream with the help of a split bamboo (*Thagalok*) that directs water to an earthen pitcher (*Kum*). Water in the stream is contributed by seepage from surrounding hills. A cross pole is sometimes used to raise the *Thagalok* so that a passer-by can directly drink cool natural water (Fig. 1, Source: Bose, 1998).

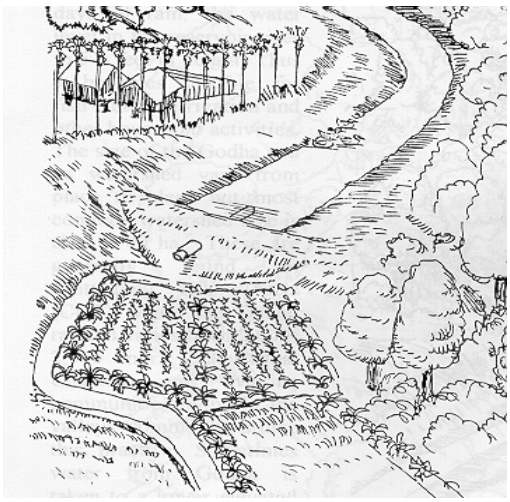

Fig. 2: Cross dam practiced in CHT

Cross-dam for Irrigation

Earthen cross-dam, 4-6 m wide and 2.5-5 m deep, is constructed across a perennial creek between two hills. The catchment area for the creek is 80-100 hectares. People use stored water for fish culture and raising ducklings. A bamboo pipe of 5 cm diameter that passes through dam is used to maintain the water level. The pipe is kept closed with a wooden plug that can be removed to lower the water level in the pond or provide water for irrigation in downstream areas. Natural vegetation in the upstream hill slopes and along the banks of the creek is maintained to minimize soil erosion and siltation of the creek (Fig. 2, Source: Bose, 1998).

Godha

This is a kind of cross-dam that is constructed across a small hill creek to collect water for the dry season.

Core of the dam is made of earth, supported on both sides by bamboo and wooden poles pegged to the ground. Inclined support posts are also used. Water stored is *Godha* is used for household and irrigation purposes. Bamboo pipes are used to carry water to the neighboring fields of lower elevation. *Godha* helps in transporting bamboo harvested in upstream areas. If long distance transport is necessary, a number of *Godhas* are built in succession. Water is released by dismantling the upper *Godha* and collected by a new *Godha* built downstream. Harvested bamboo moves with the released water to the lower *Godha*. This process is repeated to carry the harvested bamboo to the point of collection (Fig. 3, Source: Bose, 1998).

Thelya-Thok

This is similar to a *Godha* and is used for the same purposes. The dam may require a catchment area of 100 hectares. Bamboo and wooden pegs are used to support the earthen body of the dam. Horizontal and vertical pegs are called *Huda* and oblique ones are called *Thelya-Thok* after which the dam is named. The only difference with a *Godha* is that a diversion drain beside the dam is used to release excess runoff.

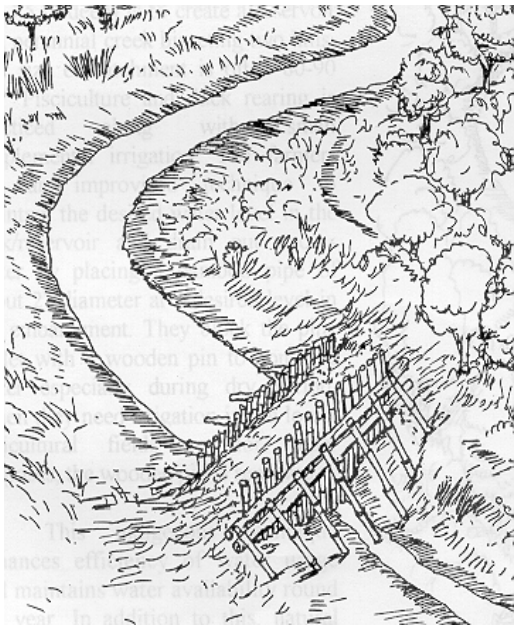

Fig. 3: *Godha* practiced in CHT

Harvesting in Flat Areas

Flatland habitants have used various forms of water harvesting both in small and large scale. These methods include small ditches within the crop fields to conserving water in large natural depressions and using that source year-round. Small scale harvesting is practiced more or less in all parts of Bangladesh. Large-scale storages are found mostly in the northeastern districts of Mymensingh and Sylhet.

Ditches in Agricultural Fields

Before the days of mechanized irrigation, farmers in different parts of Bangladesh used to maintain a small ditch at one corner of their agricultural plots of about 1 m^2. This ditch was used to hold water from rainfall for supplementary irrigation. This was practiced in the wet season for rain-fed crops. Farmers also used the same ditch to grow some indigenous fish such as *Kai*, *Shing*, *Magur*, *Shoal* and *Taki*. Thus ditches served a dual purpose and were an important source of protein for the farmers. Due to pressure on land and introduction of modern pump and canal based irrigation, this type of harvesting is rarely seen now-a-days. Another possible reason for filling up the ditch is use of pesticides that would accumulate in the ditch and intoxicate and kill the fish. Since most commercial fishponds only grow a few varieties of fish, extinction of agricultural ditches might have contributed to reducing aquatic bio-diversity.

Harvesting in Haors and Beels

Haor is a large natural depression, area of which may vary between 500 hectares to 15,000 hectares or more. A *haor* goes under water in the monsoon and becomes an enormous fishpond. Fish caught from the *haors* make up a significant part (between 10%-15%) of the total yearly catch in those regions. In the dry season, most of the *haor* dries up (with patches of water holes, the larger ones are called *beels*) and the exposed land is used for growing winter crops and grazing cattle after harvesting. Water trapped in the *beels* is used for irrigation. *Haors* are also important habitat for many water fouls and migratory birds. About 260 species of fish and 125 species of birds are found in the *haor* areas, which signify the ecological importance of this area (BCAS, 1994). In addition, *haors* are used as major transport routes in the monsoon when many low lying country roads go under water.

Although *haors* are still an integral part of life and agriculture in Mymensingh and Sylhet areas of Bangladesh, their existence are being threatened by unplanned developmental activities. *Haor* areas are being encroached and filled up for new settlements due to increased population pressure. More importantly, the natural hydrologic regime is being interrupted due to construction of roads and embankments without proper provision for flow of water and fish migration. Although water availability is not a problem in the *haor* areas and farmers are using indigenous technology such as submersible dyke for water management, fish population has been affected in recent years. Embankments are blocking river fish from entering into the *haors* that are used as spawning ground. As a result fisheries in both the *haors* and rivers are declining. Experts have recognized this problem and have attempted to mitigate through construction of fish-friendly structures.

Harvesting in Ponds

There are about 1.76 million ponds (typically 0.2-0.4 acres) in Bangladesh where water is collected from rainfall and seepage (BBS, 1997). To protect water and fish in the pond, bank of the pond is raised. Most ponds have a platform called *ghat*, made of wood or bricks, to allow easy access to water and washing and bathing. These ponds are perennial source of water in most parts of the country although some may dry up in drought years. *Ghats* are popular meeting places for women in particular as they spend a significant amount of time fetching water, washing clothes and bathing.

Previously ponds were found both in rural and urban areas. But now ponds have practically vanished from urban areas due to high land value and supply of water through tubewells or piped distribution system. A pond is a small ecosystem that supports many aquatic species such as fish, frog, snake, snail and insects. It also supports trees and plants growing along the bank by providing necessary water through seepage. Many indigenous species of birds live in those trees and bushes that feed on the aquatic species found in the pond. Thus water harvesting in ponds is supporting a very rich aquatic ecosystem all over the country.

Merits and Limitations of Traditional Methods

Like any anthropogenic practice, indigenous water harvesting methods have merits and limitations that determine where and when these methods can be used. These methods have evolved in particular socio-cultural and physical settings to serve specific needs. With change in society and influx of new technology, water harvesting methods are also undergoing changes. Some of these may not be practiced at all in future and some other may have to be reintroduced to ensure ecological balance that modern methods might have overlooked. Following is a summary of important merits and limitations of indigenous water harvesting methods.

Merits

Simple and Low Cost: All indigenous methods are easy to install and maintain. It costs very little to meet household needs through water harvesting. When larger structures such as cross dams and *Godha* are built, cost is shared by the community in the form of providing labor and raw material collected from the surroundings.

Ecological Balance: Most of the methods serve multiple purposes. These are used to grow fish and water fouls in addition to collecting and storing water. The natural surrounding is left largely undisturbed so that healthy aquatic ecosystem can develop and coexist with the community's demand for water.

No Permanent Interference: No permanent structures are built that can cause irreversible change to the local hydrology and the environment. Thus the risk of ecological damage is minimal.

Community Participation and Coherence: The social dimension of tribal life style is extremely important. Most tribal people live in small communities and closely depend on each other. Traditional methods require participation and sharing that contributes to maintaining and improving social harmony.

Limitations

Small Scale: One of the reasons why some traditional methods have become less popular is that these methods usually serve a small community. This is particularly true in hilly areas. With the increase in population due to growth and immigration from other parts of the country, water demand in hilly areas has grown many times. This demand can only be met with the help of mechanized water supply such as shallow and deep tubewells.

Area Specific Techniques: Some harvesting methods are location specific. For example, temporary cross dams can be built across small hilly streams but this can not be done across a medium sized river without a lot of prior planning. Another example is *Thagalok-Kum* that can only be built in a hilly area with a small creek. Similar creeks do not exist in the flatland. Thus indigenous concepts may not be immediately replicable.

Time and Labor Intensive: Indigenous methods are well suited with the slow paced life style of a rural community. These methods employ both men and women and keep them busy for a significant part of the day. However, in urban areas, opportunity cost of time is high and people demand more convenient and reliable water supply. Thus without appropriate modification, these methods can not be introduced in urban areas.

Promotion of Water Harvesting

Despite some limitations of indigenous methods, there are potentials for incorporating water harvesting both in urban and rural areas. Two such specific opportunities will be outlined below.

Harvesting Household Water in Urban Areas

By 2020, between 35%-40% of the population of Bangladesh will be living in urban areas. Currently water supply in most of the major cities is derived from groundwater sources. However, due to paving of ground surface, vertical recharge into city aquifers has practically stopped. As a result, in major cities like Dhaka and Chittagong, piezometric level has dropped significantly indicating mining of city aquifers. In

Dhaka, piezometric level has dropped by more than 20 meters in the last decade alone. Clearly, this is an indication of future water crisis in Dhaka that will become a *mega* city in next ten years. Part of this crisis can be dealt with by harvesting rainwater in the monsoon. On average, the city receives between 1800 to 2000 mm of rain per year of which about 80% occurs between the months of June and September. Even if we harvest 20% of this rain, it can theoretically satisfy almost all of the city's demand throughout the year. In short, there is a significant potential of harvesting rainwater for urban usage. The real challenge is to develop an appropriate technology of water harvesting that will be economic and easy to integrate with the existing water supply system. In this regard, the possibility of introducing roof top harvesting, as explored in other countries, can be investigated.

Harvesting Drinking Water in Arsenic Infested Villages

Recently, it has been detected that the concentration of arsenic in drinking water is above 0.05 ppm (acceptable level) in about 50% area of the country. This is a health hazard of national magnitude. Since the origin of arsenic is geologic, nothing can be done to remove it from the source. The alternative is to treat arsenic infested groundwater after withdrawal for which no suitable technology still exists, or to use treated surface water taken from rivers, which is expensive. This has caused a major dilemma among the planners. Rainwater harvesting may partly alleviate this crisis. Like in cities, rooftop or similar harvesting of rainwater is possible in rural areas as well (Verma, 1998).

Conclusions

It is evident that traditional water harvesting methods exist in Bangladesh both in hilly and flat areas. These technologies serve multiple purposes and have no harmful impact on the environment. However, due to a number of reasons as discussed above, some of these methods are being given up in favor of modern alternatives. One additional factor that might have contributed to this phenomenon is the long standing political unrest in CHT, which forced many tribal people to relocate. Influx of *Bengalis* from flat areas and mechanized water supply technology are also partly responsible for this loss of traditional methods. In the rest of the country, water harvesting is still being practiced through capturing water in ponds, *haors* and *beels*. These water bodies have to be protected from unplanned development activities. There are potential for introducing rainwater harvesting both in cities and villages to meet a significant part of household demands in the monsoon.

Both traditional and modern methods have merits and limitations. By incorporating beneficial elements of both into one a water supply system can be developed that will be sustainable and environment-friendly in the long run.

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