

A Review of Indian Traditional Method of Rain Water Harvesting

More, H. B. ¹

Student, Department of Civil Engineering, KBT College of Engineering, Nashik, Affiliated To SPPU,
Pune. (MS) India.¹

ABSTRACT: Sustainable traditional water harvesting techniques met the needs of local populations from many centuries. Water harvesting is the process of inducing, collecting and storing the running water. There are different types of systems to harvest rainwater in India, it includes, Surangama of Kerala, Eri of Tamilnadu, Madakas of Karnataka, Cheruvu of Andhra Pradesh, Phad irrigation of Maharashtra, Katas of Madhya Pradesh and Orrisa, Virdas of Gujarat, Nala bandha, Tank and Step well, Tohad of Rajasthan, Naula and Gul of Uttarkhand, Kul of Himachal Pradesh, Zing of Jammu and Kashmir, Kunda of Uttar Pradesh, Ahar Pynes of Bihar, Bamboo drip irrigation of Meghalaya, Apatani of Arunachal Pradesh, Dongs, Garh, and dam of Assam, Zabo of Nagaland and Jackwells of Island etc. which shows immense structural simplicity and high efficiency. Forts of India are built in different climatic condition have their own method of water harvesting to fulfil the water needs. Our temples are built century ago are with large tanks or water bodies in their premises, we must have to learn and comprehend the ancient knowledge and must apply it in modern society to get rid of present water scarcity. The ecologically safe water harvesting system are reliable and cost effective alternatives to rejuvenate India's depleted water resource. Today's Civil engineering must have to study these structure by implementing some modern new techniques. These systems must be rejuvenate to fulfil the need of water for irrigation and drinking purpose.

KEYWORDS: Hydrology, Community, Rain, Water, Harvesting, Traditional, Irrigation, Drinking, etc.

I. INTRODUCTION

We all know water is essential, but many of us think that it is unlimited, in reality fresh water is a finite resource that is rapidly becoming fewer in the source. The access to water is a basic human right, it's a social and cultural good, not merely an economic commodity. Global hydrological cycle can be referred as water democracy, because it is a system which provide water to all living beings. Water is very essential for country's development such as job creation, food security, GDP's growth, and social development etc. [1]

Global consumption of water becomes double in every 20 years, more than twice the rate of human population growth. In India, a warming climate is drying up the lake's streams and rivers, while rapid urbanisation and water pollution are putting enormous pressure on the quality and quantity of surface water and ground water. Indian agriculture still depends primarily on rainfall and also the bad monsoon season drastically affects the national economy. The ground water availability in the Indian sub-continent is highly complex due to diversified geological formations, complexity of tectonic framework, climatic variations and changing hydro-chemical environment. In recent time most of the water resource projects in India were proved to be ecologically damaging, socially intrusive and unsustainable for agricultural production. People are increasingly coming under pressure to find alternative source of water supply. Water harvesting is the process of collection and storage of water by manmade catchment areas, it includes rooftop, compound, hill slopes or artificial land surface. The amount of water harvested depends on the frequency and intensity of rainfall, catchment characteristics, water demands or how easy it is for the water to infiltrate through the subsoil and percolate down to recharge the aquifers. [2]

Water harvesting is very useful in semi-arid regions where water for irrigation is not available regularly. India has a great and long tradition of water harvesting methods. These systems were significantly developed in most arid and water stressed regions such as Kutch and Saurashtra of Gujrat and Western Rajasthan. [3] According to opinion of Li *et al*, 2000 [4], irrigation is the supplement to the crop yields. The major advantages of rainwater harvesting are they are simple, cheap, efficient, sustainable and adoptable. [5] Water harvesting can be implemented in small scale, can be

operated easily, highly adaptive and requires low cost, therefore it is ideal for socioeconomic and biophysical condition of semiarid region of rural areas. [4]

Water conservation is an important strategy that aim to alleviate the water scarcity in India. In Indian rainfall pattern changing almost every year, the Indian government has started looking at means to receive the traditional systems of water harvesting in the country, because these systems are simple, eco-friendly, highly effective, and good for environment. History tells us both floods and droughts were regularly occurring in ancient India. Therefore, every region of country has its own traditional water harvesting system that reflects its geography and culture. Archaeological evidence shows that the practice of water conservation is deep rooted in the science of ancient India. Excavation in Indus valley showing excellent water harvesting and drainage system. The settlement of Dholavira laid out on a slope between two storm water channels is a great example of water engineering. Drawing upon centuries, Indians build structures to catch, hold and store monsoon rainwater for dry seasons. [6]

Today there is a need to study some traditional water harvesting techniques. Here is a brief account of some of the unique water conservation systems prevalent in India.

II. OBJECTIVES

1. To revive the traditional water harvesting techniques in the country.
2. These places are very famous in today's time also and these places are found to be good for hydrology engineering students.

III. MATERIAL

The following information and Figures are collected from books, journals, and online/internet sources.

Waterconservation practices in India:

1. **Kerala: Surangam-** It is the type of tunnel that divert the water away from a well that is dug deep into the ground. At the mouth of the surangam, a reservoir is constructed to collect and store the water. This practice was widely used in Kerala.
Karambu- By using brushwood, mud and grasses the temporary dam stretching across the mouth of channels is called as Karambu. It is especially made to boost the water level within the canal and to divert that water into field channels also. Water is allowed from one field to other. (Fig.1 and 2)
2. **Tamil Nadu: Eri, Ooranis-** This is the rich water resource heritage system, people used to depend on the monsoon rains for irrigation and drinking purpose. This system was made 1500 years ago, these thousands of tanks not only recharge and the ground water table but also provides water for drinking and irrigation. About one third(1/3) of irrigation is by Eris(tank). [3] Eris are important for ecological water during heavy rainfall. It recharges the groundwater of the surrounding areas. Majority of these tanks were built during 6th to 10th century. Villages was allocated for the maintenance of the Eris and other irrigation structures.[7](Fig.3)
3. **Karnataka: Madakas, Neeruganti-** Madakas are naturally occurring depression and gravity is utilised to divert the rain water and that runoff was then stored. The Neeruganti was a person who has develop that system for irrigation. This practice is used even today in Uttarakhand to maintain and to distribute water from guts and that person is known as Kotwal. In this system, the water from reservoir would be diverted to different fields. Usually, the village elects or nominates a person, who look and manage this system.
4. **Andhra Pradesh: Cheruvu-** A Cheruvu can be a tank or a small pond that was used as a reservoir to store and conserve water. Today these water bodies are highly polluted.
5. **Maharashtra: Bhandara Phad irrigation, Ramtek-** Bhandara is a check dam that can be constructed on river or streams to increase the water level. That water is channelized and commonly used for irrigation at village level. Villagers can maintain this system. It was very popular practice in ancient times, it is now redundant and in some places this technique is recharged since this technique is found to be eco-friendly.(Fig.4)

The Ramtek is the town of Maharashtra where the water harvesting practice was originated. It is an elaborated network of channels with the underground supply and the water is channelized through this extensive network of tanks, polis that is useful for water supply. (Fig.5)

6. **Madhya Pradesh and Orissa: Katas, Mundas, Bandhas-** Small check dams which were erected is called Katas. The entire area would be blocked off to collect the water in a region which would serve to help the community needs for irrigation. The shape of Katas is triangle or rectangle like, commonly used for large fields.
7. **Gujrat: Virdas-** Virdas are shallow holes which are made by sands of dry riverbed and lakes for collecting drinking water. These structures are very common in Runn of Kutchs in Gujrat. This area is very typical in topography, it shows undulation with depression on the ground. In Virdas the freshwater remains in the upper layer and saline water remains below freshwater zone because of higher density. The harvesting system depends on the grass cover of the adjacent areas which is essential for free infiltration of ground water. The local nomadic people(Maldharis) established these unique structures in Gujrat Kutch area. [8]
8. **Rajasthan:**
 - a) **Naada/Bandha-** These are found in the Mewar region of the Thar Desert. It is stone masonry check dam across a stream. This structure is useful to capture monsoon runoff on stretch of land. Due to the deposition of silt deposits on these structures the land becomes fertile. [3]
 - b) **Johads-** Revival of old water harvesting system in Rajasthan by non-governmental organisation called Johad. Johad are simple stone and mud barriers built across the slope to arrest rain water. A Johad prevent rain water from running off, allowing it to percolate into the ground, recharging water aquifers and improve the water balance of the earth. [9] (Fig.6)
 - c) **Talabs-** This is the local name used for water harvesting. They are situated in village and natural depression. The talabs which have well in their beds called as Beris. Ranisar (1490 AD) is the oldest talab in Rajasthan. Today also there are many talab in Rajasthan are good source of potable water. [10] (Fig. 7)
 - d) **Tankas/Tanks-** These are the underground structures mostly found in the houses of Bikaner (Rajasthan). They are built in the main house, they are circular holes made in the ground, lined with the fine polished lime, in which rainwater was collected. These structures were decorated with tiles, which helps to keep water cool. The water was used only for drinking purpose [11]. In contrast, tanks are the one with large walls, with enormous water holding capacity. The tanks are with large catchment area and a system of canals. Fatehsagar is the oldest tank built in 1780. [12] (Fig.8)
 - e) **Stepwells or Baoli-** These are the wells having descending step. They may be multi-storied with the steps. The step well can be considered to originate from the need to ensure water during drought and in the deep relationship of faith in the water God on conspicuous event in the Vedas of around 1000 BC. These structures are common in Gujrat and Rajasthan. Stepwells also served as a place for social gathering and religious ceremonies, usually women were more associated with these wells. This wells are cool, quiet retreats during the hot summer. [13] (Fig. 9)

Jhalara is the local name to the step wells. Which were human made tanks. Jhodhpur city has eight Jhalaras. The oldest Jhalara is the Mahamandir Jhalara which dates back to 1660 AD.
9. **Uttarakhand: Naula, Gul, Dhara, Simar, Khel-** Uttarakhand and Himalayan ranges has rich traditional water conservation. Naula is made traditionally from stones and it is basically a small hut like that houses a spring. Gul is more of a system to divert and supply water rather than to store water. Gul are small channels that originate from a source and then are diverted to fields. Nowadays, Gul are a permanent features and usually built from stone masonry works. Dhara is a simple spring source. In Uttarakhand this practice provided with attractive features such as mouth of a lion and bull at the mouth of the spring. Such Dhara can be found near temples and important root points such as Bus stations.



Fig.1 Surangam [15]

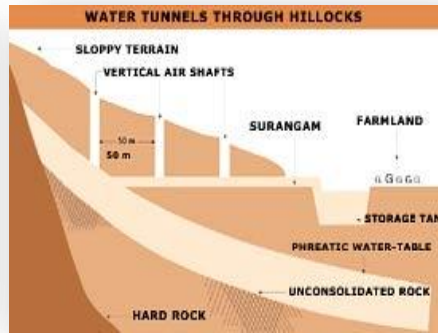


Fig.2 Suragam[15]



Fig. 3 Chembarambakkam lake (Eri)[16]



Fig.4 Phad [17]



Fig.5 Ramtek [18]

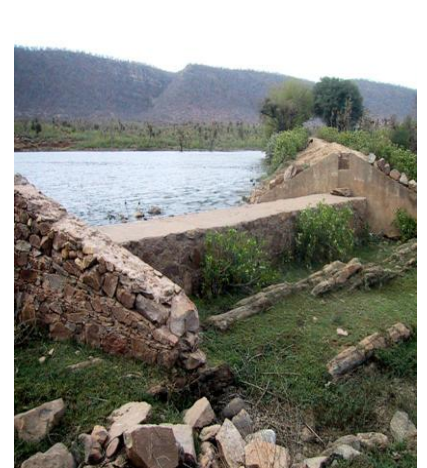


Fig.6 Johad[19]

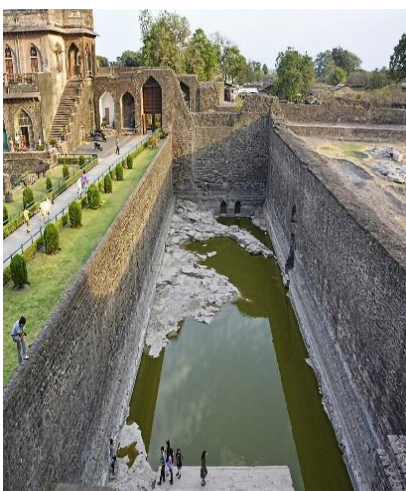


Fig.7 Talab [20]



Fig.8 Taankas [21]

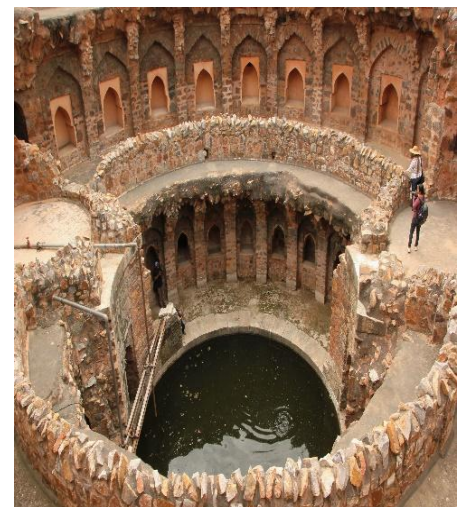


Fig.9 Baoli [22]

10. **Himachal Pradesh: Kul, Khatri-** Kul is similar like Gul and is with channel to divert away water from a source (From glacier). Khatri is the rain water harvesting tank built by stones just to prevent water percolation.
11. **Jammu and Kashmir, Ladakah: Zing-** Zing is the system made for collecting water from melting glaciers. In Jammu, Kashmir and Ladakah, zings are small tanks that collects melted water from glaciers and can be used for other reasons. (Fig. 10)
12. **Uttar Pradesh: Kunds-** It is saucer shaped and made for harvesting rain water. The lining is done with lime which prevent contamination of water. A wire mesh across water inlets prevents contamination falling into the well pit. Water is usually drawn out with a bucket. Most of the kunds are privately owned. [12] (Fig. 11)
13. **Bihar: Ahar, Pynes-** It is the traditional flood water harvesting system in south Bihar by using land slope. Rivers in this region swell only during monsoon but the water is swiftly carried away or percolated down into the sand. An ahar is a rectangular earth filled attachment basin with three sided embankments, built at the end of small pynes. Both ahars and pynes carry water during the rainy season. Pynes are the artificial channels constructed to utilize river water in agricultural fields. [12] (Fig. 12)
14. **Bengal's: Inundation channel-** In Bengal river flood during monsoon is very common and the system of overflow irrigation was very popular which uses the flood water of the Ganges and Damodar river during monsoon. These channels were broad and shallow, carrying flood water from river. Canal beds are free from coarse sand and contain fine clay. The canals were long and parallel to each other. Irrigation was done by cuts in the bank of the canal, it was closed after flood. This system enriched the soil and ensured a supply of water to every individual field.
15. **Meghalaya: Bamboo Drip irrigation-** This is the ingenious system especially used for black pepper cultivation in the state of Meghalaya. Here Bamboo channels are used to divert the water away from a source such as a spring and through bamboo channels the water reaches up to the field and used for irrigation purpose. (Fig. 13)
16. **Arunachal Pradesh: Apatani-** This system developed by Apatani tribes of Arunachal Pradesh, this is the wet rice cultivation seed fish farming system. The field is terraced into plots separated by dams which are in turn supported by bamboo frames. All plots have water and outlets on opposite sides. The water of low-lying plot functions as an outlets of the high-lying plot, deeper channels connect the water to purpose. (Fig. 14)
17. **Assam: Dongs, Garh and Dam-** Dongs are ponds constructed by the Bodo tribes of Assam to harvest water for irrigation. By using Lahori instrument water was lifted from the ponds and distributed. These ponds are individual owned and no involvement of community for digging and maintainance.
 In Assam, the Garh is also built to channelize river water to the agricultural field like big nala. The paddy field is divided into small pieces in square size, creating small embankment, called Dara. Here rain water is stored for cultivation. [9]
18. **Nagaland: Zabo-** This system combines water conservation with foresting, agriculture and animal care. It promotes soil management, environmental protection and sustainable water management. Village such as Kikruma and Zabo are located at high altitude, in spite of heavy rainfall, the people experience water scarcity. The water is collected in pondlike structures in the middle of terrace. The other i.e. forest is on the top of hill, cattle yards below the pond area and paddy field at the bottom of hill. This structure can be maintained before monsoon. [3] (Fig. 15)
19. **Island: Jackwell-** This system developed in Nicolas Island by local tribes. The shompen tribals used to harvest water. In lower part of the undulating terrain, bunds were made by using logs of hard bullet wood. They also uses split bamboos in their water harvesting system. A full length of bamboo is cut longitudinally and placed along a gentle slope with the lower end leading into shallow pit. This acts as a channels and collecting rainwater in pits called Jack wells. A series of increasing bigger jack wells is built and connected by bamboo so as to form the biggest jack well with approximate diameter of 6m and depth of 7m to ensure like overflow from one to another. [12] (Fig. 16)



Fig. 10 Zing [23]



Fig. 11 Kundas [24]



Fig. 12 Ahar, Pynes [25]



Fig. 13 Bamboo Drip Irrigation [26]



Fig. 14 Apatani [27]

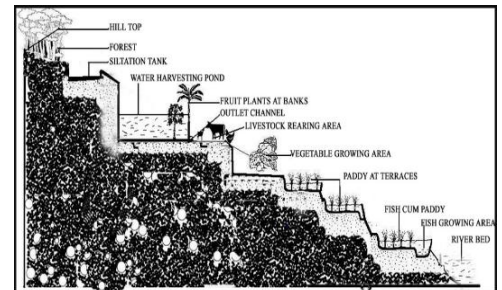


Fig. 15 Zabo [28]



Fig. 16 Jackwell [29]

IV. CONCLUSION

Today it is absolutely very essential for us to secure the water resources. There are many policies developing in many countries for water management. But this now need to rejuvenate the traditional water management system to fulfil the need of water. We must have to learn the ancient knowledge and apply it in our modern society to get rid on water stressed condition to restore the ancient system of water harvesting to tackle the modern problems of agriculture and drinking water supply. These ecologically safe traditional water harvesting systems are reliable and cost-efficient alternatives to rejuvenate India’s depleted water resources. Combining these structures with modern rainwater saving techniques i.e. percolation tank, injection of wells and surface barriers, will be the answer to India’s perennial water uses.

REFERENCES

[1]. UNESCO. 2009. *World Water Assessment Programme. The United Nations World Water Development Report 3: Water in a changing world.* Retrieved April 5, 2011, from: http://www.unesco.org/water/wwap/wwdr/wwdr3/pdf/WWDR3_Water_in_a_Changing_World.pdf
 [2]. Srinivasan, R.K., Babu S.S.V. 2000. *A Water Harvesting Manual for Urban Areas.* Centre for Science and Environment, New Delhi, India.

- [3]. Agarwal A., Narain S. (ed.) 1997. *Dying wisdom: Rise, fall and potential of India's traditional water harvesting systems. (State of India's Environment – A Citizens' report, No. 4)*. Centre for Science & Environment (CSE), New Delhi, pp. 11-12.
- [4]. Li, F., Cook, S., Geballe, G.T. and Burch, W.R., Jr. 2000. *Rainwater harvesting agriculture: an integrated system for water management on rain-fed land in China's semi-arid areas*. AMBIO 29, 477–483.
- [5]. Reiz, C., Maulder, P., Begemann, L. 1988. *Water harvesting for plant production*. World Bank Technical Paper 91, Washington, DC, USA.
- [6]. <http://www.thebetterindia.com>
- [7]. Bhalge, P. and Bhavsar, C. 2007. *Water management in arid and semi-arid zone: Traditional wisdom*. International History Seminar on Irrigation and Drainage, Tehran-Iran, pp. 423-428.
- [8]. Centre for Science and Environment. *Rainwater Harvesting*. (Accessed on February, 2015, URL: <http://www.rainwaterharvesting.org/rural/Traditional3.html>)
- [9]. Borthakur, S. 2008. *Traditional rain water harvesting techniques and its applicability*. Indian Journal of Traditional Knowledge, 8(4): 525-530.
- [10]. Mishra, A. 2011. *The Radiant Raindrops of Rajasthan*. Research foundation for science, technology and ecology, New Delhi, India.
- [11]. Ministry of rural development. 2004. *Water harvesting and artificial recharge*. Rajiv Gandhi National Drinking Water Commission, Govt. of India.
- [12]. Dhiman S.C., Gupta S. 2011. *Rainwater Harvesting and Artificial Recharge*. Central Ground Water Board, Ministry of Water Resources, New Delhi.
- [13]. Davies, P. 1989. *The Penguin guide to the monuments of India*. London: Viking.
- [14]. Joji VS (2018) *Traditional Rainwater Harvesting and Water Conservation Practices of Kerala, South India*. J Aquat Res Mar Sci 2018: 84-90.
- [15]. http://www.rainwaterharvesting.org/Rural/west_ghat_tradi.htm
- [16]. <https://www.ixigo.com/chembarambakkam-lake-reviews-ne-1355561>
- [17]. <https://www.indiawaterportal.org/articles/oasis-hope-land-suicides>
- [18]. <https://www.panoramio.com/>
- [19]. <http://www.ecotippingpoints.org/our-stories/indepth/india-rajasthan-rainwater-harvest-restoration-groundwater-johad.html>
- [20]. <https://www.indiawaterportal.org/articles/water-treated-royally-mandus-jahaz-mahal-ship-palace>
- [21]. <https://en.wikipedia.org/wiki/Taanka>
- [22]. https://commons.wikimedia.org/wiki/File:A_Baoli_in_Ferozshah_Kotla_New_Delhi.jpg
- [23]. <http://homegrown.co.in/the-answer-to-indias-water-woes-may-lie-in-its-history/>
- [24]. <http://www.hoparoundindia.com/pagegone.aspx?aspxerrorpath=/uttar-pradesh/kosi-kolan-attractions/kunds.aspx>
- [25]. <http://www.indiawaterportal.org/articles/ahar-pynes-traditional-flood-water-harvesting-systems-can-help-revive-agriculture-south>
- [26]. <http://permaculturenews.org/2014/02/28/bamboo-drip-irrigation/>
- [27]. http://www.cprecevis.nic.in/Database/ApataniFarmingSystem_3788.aspx
- [28]. http://www.cprecevis.nic.in/Database/ZaboFarmingSystem_3769.aspx
- [29]. <https://www.thebetterindia.com/61757/traditional-water-conservation-systems-india/>