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Traditional Water Conservation and Management systems in India

Chavan Awinash¹, Chakre Rakshanda²

^{1,2} Raosaheb Patil Danve College of Pharmacy, Badnapur, Dr. Babasaheb Ambedkar Marathwada University Aurangabad, Maharashtra, India

Corresponding Author: Chavan Awinash

Abstract

Water is considered to be one of the nature's precious gifts to mankind and everyone present on this planet (animal, plant and other microorganisms). Water is the unique source of life, without which we cannot imagine the life here. Life on other planets is not possible just because of the absence of water. Due to impact of rising population, changing of climate and rapid urbanization India's natural resources are becoming acute. To meet the water demand of 1.3 Billion people and its future generation and for sustainable development water is becoming a rarest commodity soon if the general public is not educated for significance of storing, recycling and reusing multiple times. Water conservation need of the present-day to overcome the global impacts of water scarcity is highly necessary. Water conservation measures are the first-line option for the control and management of subsurface

drainage water. This article focuses on some of the prominent and typical Traditional Methods of Water Conservation and Management Techniques prevailing across the country, in order to help in bringing the strategic change towards revival of them such that sustainable solutions are worked out without abolishing what has been done till date. The traditional Indian methods of Water Conservation and Management are promising even in the present era of technology, can be achieved through strict water management, which broadly includes advanced scientific application methods in all areas of water utilization, plugging wastage and losses, reducing pollution and creating awareness among people about scarcity of water and the need to conserve.

Keywords: Water Conservation, Traditional System, Groundwater Management, Agricultural System

Introduction

Water is one of the five elements (Pancha bhoothas), created by god almighty, for survival of mankind. It is a sacred element available only on planet Earth in the entire Universe. Out of the entire water available on the Earth, only 1% is fit for human consumption, balance being Sea / salt / ice water. Out of this 1%, about 99% is in the form of ground water and only 1 % is available as surface water in lakes and rivers (Baumann, Boland, & Sims, 1984) ^[1]. As the technology developed, we started using the ground water also for drinking and agriculture, As the population grew, we are fully utilizing the available surface/ground water for drinking, domestic, agriculture, industrial, power generation etc. purposes (Russo, Alfredo, & Fisher, 2014) ^[10]. Water has always remained the most important consideration for evolution and development of human civilization (Fatta-Kassinos, Dionysiou, & Kümmerer, 2016) ^[4]. All ancient cultures such as Indus Valley Civilization (India), Yellow River Civilization (China), Nile River Civilization (Egypt) etc. developed and flourished along the rivers banks as it provided all the necessary supports for life and day to day activities of human (Ramappa, Reddy, & Patil, 2014) ^[9]. Initially, many thousand years back, very exhaustive use of water resources was possible as there was plenty of water available and population compared to present day was very less. But present day, there is burst of population all over the globe, which has put undesirable pressure on all natural resources including water (Joseph G. Cleary, 2006) ^[7].

Water conservation

Water conservation includes all the policies, strategies and activities to sustainably manage the natural resource of fresh water, to protect the hydrosphere, and to meet the current and future human demand. Population, household size, and growth and affluence all affect how much water is used (Saxena, 2017) ^[11]. Factors such as climate change have increased pressures on natural water resources especially in manufacturing and agricultural irrigation. Many US cities have already implemented policies aimed at water conservation, with much success (George, Pillai, & Mathew, 2015) ^[5].

Why Conserve Water?

Water is essential to life on earth. We need water to grow food, keep clean, provide power, control fire water conservation helps prevent water pollution in nearby ponds, lakes, rivers and local watersheds (Cosgrove & Loucks, 2015) ^[2]. People use up our planets fresh water faster than it can naturally be replenished so, save water for the Earth, family and community. Water is known as the elixir of life. Hence, to ensure a better tomorrow for our generation, water conservation is necessary (Delgado et al., 2011) ^[3].

Water Management in India

As per the guideline and commitment with world water organization, India as a member country have its own national water policy, environmental policy, vision and mission for implementing this programme (Hodgson, Sharville, Silverstein, & McKenna, 2018) ^[6]. Union government has allotted fund for it. Central government started clean Ganga mission to recycle and reuse waste water (Xia, Guo, & Huang, 2011) ^[12].

Traditional Methods of Water Conservation and Management

The traditional techniques, though less popular today, are still in use and efficient. Brief details of these techniques of water conservation and management systems prevalent in India which have been in practice for decades even before the debate on climate change even started, based on ecological regions of India are shown in table 1.

Table 1: Water Conservation System based on ecological Regions of India

Ecological Region	Traditional Water Conservation & Management System
Trans- Himalaya Region	Zing
Western Himalaya	Kul, Kuhl, Khatri
Eastern Himalaya	Apatani
North Eastern Hill Ranges	Zabo
Brahmaputra Vallay	Dongs/ Dungs
Indo-Gangetic Plains	Ahars- Pynes, Dighis, Baolis
The Thar Desert	Kunds, Baoris, Jhalaras, Nadi, Tobas, Taankas, Khandins, Vav/Bavadi
Central Highlands	Talab, Bandhis, Johads, Naada/Bandh, The Pat System, Chandela Tank
Eastern Highlands	Katas/ Mundas/ Bandas
Deccan plateau	Kohli Tanks, Bhadaras, Phad, Kere, The Ramtek Model
Western Ghats	Surangam
West Coastal Plains	Virdas
Eastern Ghats	Korambu
East Coastal Plains	Eri/ Ooranis
The Island	JackWells

Bawari

Bawaris are unique stepwells that were once a part of the ancient networks of water storage in the cities of Rajasthan. The little rain that the region received would be diverted to man-made tanks through canals built on the hilly outskirts of cities. To minimise water loss through evaporation, a series of layered steps were built around the reservoirs to narrow and deepen the wells.



Fig 1: Bawari



Fig 2: Taanka

Taanka

Taanka is a traditional rainwater harvesting technique indigenous to the Thar Desert region of Rajasthan. A Taanka is a cylindrical paved underground pit into which rainwater from rooftops, courtyards or artificially prepared catchments flows. An important element of water security in these arid regions, taankas can save families from the everyday drudgery of fetching water from distant sources.

Ahar Pynes

Ahar Pynes are traditional floodwater harvesting systems indigenous to South Bihar. Ahars are reservoirs with embankments on three sides that are built at the end of diversion channels like pynes. Pynes are artificial rivulets led off from rivers to collect water in the ahars for irrigation in the dry months.



Fig 3: Ahar Pynes



Fig 4: Penam Keni

Penam Keni

The Kuruma tribe (a native tribe of Wayanad) uses a special type of well, called the panam keni, to store water. Wooden cylinders are made by soaking the stems of toddy palms in water for a long time so that the core rots away until only the hard outer layer remains. These cylinders, four feet in diameter as well as depth, are then immersed in groundwater springs located in fields and forests.

Johads

Johads, one of the oldest systems used to conserve and recharge ground water, are small earthen check dams that capture and store rainwater. Constructed in an area with naturally high elevation on three sides, a storage pit is made by excavating the area, and excavated soil is used to create a wall on the fourth side. This prevents structural damage to the water pits that are also called madakas in Karnataka and pemghara in Odisha.



Fig 5: Johad



Fig 6: Talab

Talab / Bandhi

Talabs are reservoirs that store water for household consumption and drinking purposes. They may be natural, such as the *pokhariyan* ponds at Tikamgarh in the Bundelkhand region or manmade, such as the lakes of Udaipur. A reservoir with an area less than five *bighas* is called a *talai*, a medium sized lake is called a *bandhi* and bigger lakes are called *sagar* or *samand*.

Kund

A kund is a saucer-shaped catchment area that gently slope towards the central circular underground well. Its main purpose is to harvest rainwater for drinking. Kunds dot the sandier tracts of western Rajasthan and Gujarat. Traditionally, these well-pits were covered in disinfectant lime and ash, though many modern kunds have been constructed simply with cement. Raja Sur Singh is said to have built the earliest known kunds in the village of Vadi Ka Melan in the year 1607 AD.



Fig 7: Kund



Fig 8: Khadin

Khadin

Khadins are ingenious constructions designed to harvest surface runoff water for agriculture. The main feature of a khadin, also called dhora, is a long earthen embankment that is built across the hill slopes of gravelly uplands. Sluices and spillways allow the excess water to drain off and the water-saturated land is then used for crop production. First designed by the Paliwal Brahmins of Jaisalmer in the 15th century, this system is very similar to the irrigation methods of the people of ancient Ur (present Iraq).

Bhandara Phad

Phad, a community-managed irrigation system, probably came into existence a few centuries ago. The system starts with a *bhandara* (check dam) built across a river, from which *kalvas* (canals) branch out to carry water into the fields in the phad (agricultural block). *Sandams* (escapes outlets) ensure that the excess water is removed from the canals by *charis* (distributaries) and *sarangs* (field channels). The Phad system is operated on three rivers in the Tapi basin – Panjhra, Mosam and Aram – in the Dhule and Nasik districts of Maharashtra.



Fig 9: Bhandara Phad

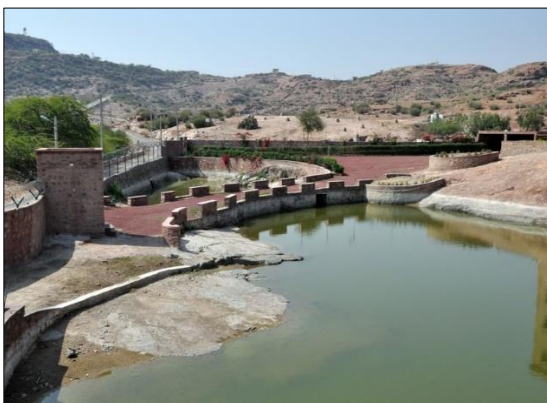


Fig 10: Nadi

Nadi

Found near Jodhpur in Rajasthan, nadis are village ponds that store rainwater collected from adjoining natural catchment areas. The location of a nadi has a strong bearing on its storage capacity and hence the site of a nadi is chosen after careful deliberation of its catchment and runoff characteristics. Since nadi received their water supply from erratic, torrential rainfall, large amounts of sandy sediments were regularly deposited in them, resulting in quick siltation.

Kuhl

Kuhls are surface water channels found in the mountainous regions of Himachal Pradesh. The channels carry glacial

waters from rivers and streams into the fields. The Kangra Valley system has an estimated 715 major kuhls and 2,500 minor kuhls that irrigate more than 30,000 hectares in the valley. An important cultural tradition, the kuhls were built either through public donations or by royal rulers.



Fig 11: Kuhl

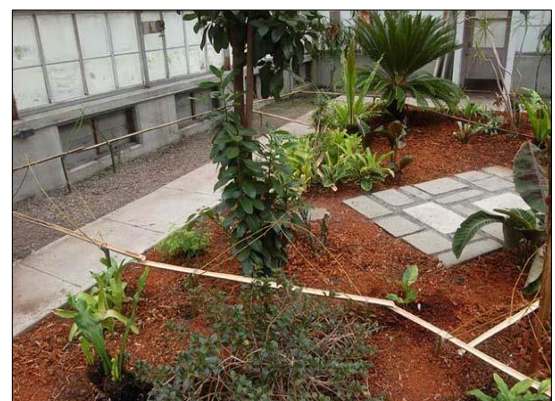


Fig 12: Bamboo Drip irrigation

Bamboo Drip irrigation

Bamboo Drip irrigation System is an ingenious system of efficient water management that has been practised for over two centuries in northeast India. The tribal farmers of the region have developed a system for irrigation in which water from perennial springs is diverted to the terrace fields using varying sizes and shapes of bamboo pipes. This ancient system is used by the farmers of Khasi and Jaintia hills to drip-irrigate their black pepper cultivation.

Zabo

The Zabo (meaning ‘impounding run-off’) system combines water conservation with forestry, agriculture and animal care. Practised in Nagaland, Zabo is also known as the Ruza system. Rainwater that falls on forested hilltops is collected by channels that deposit the run-off water in pond-like structures created on the terraced hillsides. Ponds created in the paddy field are then used to rear fish and foster the growth of medicinal plants.

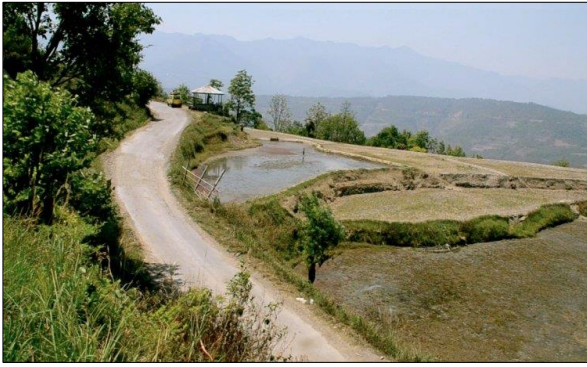


Fig 13: Zabo

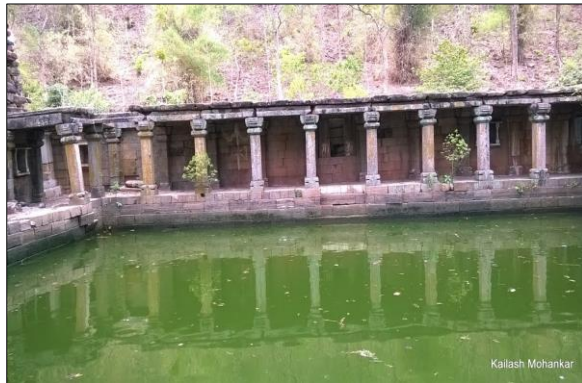


Fig 14: Ramtek model

Ramtek model

The Ramtek model has been named after the water harvesting structures in the town of Ramtek in Maharashtra. An intricate network of groundwater and surface water bodies, this system was constructed and maintained mostly by the malguzars (landowners) of the region. In this system, tanks connected by underground and surface canals form a chain that extends from the foothills to the plains. This system conserves about 60 to 70 % of the total runoff in the region.

Eri

The Eri (tank) system of Tamil Nadu is one of the oldest water management systems in India. Still widely used in the state, eris act as flood-control systems, prevent soil erosion and wastage of runoff during periods of heavy rainfall, and also recharge the groundwater. The tanks are interconnected in order to enable access to the farthest village and to balance the water level in case of excess supply. The eri system enables the complete use of river water for irrigation and without them, paddy cultivation would have been impossible in Tamil Nadu.



Fig 15: Eri



Fig 16: Jhalara

Jhalara

They are typically square shaped step-wells with beautiful arches, motifs and sometimes rooms on sides. Apart from storing water for basic needs, they at times also served for water sports. Located away from residential areas, the water quality in these Bawdis is considered to be good for consumption. The typical lifespan of Jhalaras is around 20-30 years.

Apatani

It is a multipurpose water management system, which integrates land, water and farming systems by protecting soil erosion, conserving water for irrigation and paddy-cum-fish culture. This is wet rice cultivation cum fish farming system practiced in elevated regions of about 1600 m and gentle sloping valleys, having an average annual rainfall about 1700 mm and also rich water resources like springs and streams. This system harvests both ground and surface water for irrigation. It is practiced by Apatani tribes of Ziro in the lower Subansiri district of Arunachal Pradesh.



Fig 17: Apatani



Fig 18: Roof top water harvesting

Roof top water harvesting in Mizoram

In Mizoram most of the hills are steep having slope more than 50 per cent and are separated by deep river gorges. Despite of heavy monsoon rain, the people face acute water problems every year in the dry season. The geological formation does not permit water retention; runoff is quick and springs and small streams dry up when there is no rain. Roof top harvesting structures for drinking purpose have been developed locally and now spread in the entire Mizoram. It has proved to be quite successful. Most houses are built with sloping roofs with galvanized iron sheets which are conducive to rain water harvesting.

There are several other hyperlocal versions of the traditional method of tank irrigation in India. From *keres* in Central Karnataka and *cheruvus* in Andhra Pradesh to *dongs* in Assam, tanks are among the most common traditional irrigation systems in our country.

These ecologically safe traditional systems are viable and cost-effective alternatives to rejuvenate India's depleted water resources.

Conclusion

To bridge the gap between supply and demand of water in coming future, integrated water resource management (IWRM) seems to be the only way out as a prudent strategy of water conservation and management, in which different river basins will have different master plans integrating the various traditional, conventional and modern innovative methods applicable in that basin. India is not a water deficit country, but due to severe neglect and lack of monitoring of water resources development projects, several regions in the country experience water stress from time to time. It is therefore necessary to prevent this crisis by making best use of the available technologies and resources to conserve the existing water resources, convert them into utilizable form and make efficient use of them for agriculture, industrial production and human consumption. Imposing regulatory measures to prevent the misuse of water and introducing rewards and punishment to encourage judicious use of water, will be helpful to conserve water. Finally, awareness and orientation of all the water users to change their lifestyle to conserve water can help the country to tide over the water crisis in the future.

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