

CHAPTER 2

An Insight into the Traditional Water Conservation Systems in India

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Received: 20 May 2025; Accepted: 24 July 2025; Available online: 18 August 2025

Abstract

Water is a prime natural resource which satisfies basic human need. Due to ever-increasing population, urbanization, industrialization as well as poor irrigational practices there has been a hike in demand for clean water for domestic and commercial use. This has led to a dearth in water availability in general. Traditional water conservation techniques in India has been an age long practice and our ancestors were adept at perfecting the art of judicious use and management of this precious resource. In today's world where overexploitation and wastage of resources commands a premium, there is an urgent need to drop down to traditional water conservation methods which are an amalgamation of sustainability and economics. Thus, this chapter outlines some of such traditional water conservation practices being practiced in various parts of India.

Keywords: Water conservation, Johads, tanks, indigenous, sustainable.

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Principles of Ecology (Vol. 3) - Sudarshan S. Pedge & Pallavi N. Chavan (Eds.)

ISBN: 978-93-95369-98-5 (paperback) 978-93-49630-97-0 (electronic) | © 2025 Advent Publishing. All rights reserved.

<https://doi.org/10.5281/zenodo.16895106>

Introduction

Water is one of the most typical and valuable natural and renewable resource on Earth. The hydrosphere, which is primarily composed of water, covers approximately three-fourths of the earth's surface (75%). Its scope extends beyond just meeting basic human requirements; it is an absolutely necessary component for the survival of all kinds of life on Earth. Water has been crucial for the survival of humans and ecosystems from the beginning of human history (Biswas, 2006).

Water is invaluable gift of Mother Nature that we tend to waste like a free commodity. The hydrosphere of Earth comprises the oceans (97.2%), glaciers, ice caps, and ice sheets (1.8%), ground water (0.9%), fresh water from lakes, inland seas, and rivers (0.02%), and atmospheric water vapour (0.001%) (Baboo, 2009). That leaves us with only a limited amount of groundwater and freshwater resources that's fit for human consumption as the major part is contributed by saline water whose treatment and desalinization is a luxury and infeasible. The ever-increasing population, industrialization, and urbanization are all putting a strain on our limited water resources. The current scenario paints a picture that clearly depicts only a sustainable management plan to conserve water can cater to the needs of the future generation. According to the data provided by The Ministry of water Resources, RD & GR, the current water usage is approximately 750 BCM, while the projection for the year 2050 is predicted at 1180 BCM (Rao, 2018). This significant demonstrates how critical it is to conserve water and preserve it from contamination if the consumption continues to be in the range without any replenishment strategies.

Need for conservation and management of water

- Since independence, the challenge for management and conservation of water has increased multiple folds owing to reasons like rising demands, environmental degradation and depletion.
- According to Central Water Commission, in 2021, annual per capita water availability decreased from 5,200 cubic meters in 1951 to 1,486 cubic meters (Central Water Commission, 2020-2021).
- India experiences the "too much and too little water syndrome," a recurrent phenomenon of drought and precipitation resulting from variable weather patterns.

India is presently the world's largest groundwater extractor, accounting for 25% of the global total. More than 70% of our water sources are contaminated, and our major rivers are dying due to pollution.

- A Central Water Commission research calculated the average annual water resources of India's 20 river basins at 1,999.20 billion cubic metres (BCM). It estimated that the country's usable water is 1,126 BCM owing to topographical, hydrological, and various other limitations.

Traditional Water Conservation methods

Since time immemorial, the techniques of water conservation have been lauded, devised and utilized in India. Although the unique intricacies of development and the basic structural frame of the traditional water conservation throughout the country are diversified and rely heavily on the mainland's geography, the motive remains the same i.e. to collect, recycle and optimize the use of various water resources. The

archaeological remains of the prehistoric times hold enough confirmations of modest and progressive water conservation and harvesting systems that have been relevant in the past. Even the ancient Indian literature like the Ramayana, Puranas, Mahabharata, and various Vedic, Buddhist and Jain texts contain references to canals, tanks, embankments and wells (Sarma & Aggarwal, 2023).

People continue to use archaic conventional water harvesting technologies used by ancient civilizations. The archaeological remains of Indus valley civilization gives an insight into an excellent system of water harvesting and drainage that was being used by the people in those days. Another fair example for water channelling and storage is the stormwater channels of Dholavira settlement. Thus, it is needless to say that people of today are flag bearers of the people of the past in the context of traditional water conservation methods. Each of our ancestors have perfected the art of water management and we have certainly learnt from them. Many water harvesting structures and water conserving mechanisms were followed in each region of the country. The storing mechanisms or the water receptacle was named differently in different areas (Table 1).

Table 1: Traditional Water Harvesting Systems

States/ Areas	Name of the Traditional Water Harvesting System
Rajasthan	Kunds, <i>Jhalaras</i> , <i>Tobas</i> , <i>Khadin</i>
Gujarat	Tankas, <i>Virdas</i>
Maharashtra	Phad System
Andhra Pradesh	Tanka and Anicuts
Orissa	Katas
Karnataka	Teluparagis and Kere
Himachal Pradesh	Khatri, Kuhl, Kul
Gangetic plains	Baolis , Dighis
Central India	Johads
Western Ghats	Surangam
Eastern Ghats	Korambu
Ladakh	Zing
Eastern Himalayas	Apatani
North eastern Hill ranges	Zabo, Cheo-ozih
Central Highlands	Talab / Bandhis, SazaKuva, Rapat
South Bihar	Ahar Pynes
Uttarakhand	Naula, Dhara, Gul

Johads

During 1985-86, the Alwar area of Rajasthan experienced severe drought. In 1985, volunteers from Rajendra Singh's Tarun Bharat Sangh (TBS) visited Alwar. They established the tradition of constructing 'Johads', a type of traditional technology that provided water for usage and recharged groundwater. These miraculously transformed the lives of the locals who were dealing with abject poverty who, with the much required interjection, were now leading a prosperous life (Frontline, 2001). Johads are earthen check dams or embankments that catch and store rainwater, improving percolation and groundwater recharge. These are mud and rubble obstructions constructed along the contour of a hill for catching rainwater. Three sides have steep embankments, while the fourth side is left free to allow rainfall to enter. The height of each Johad varies based on factors such as site, water flow, and curves. To relieve water pressure, a masonry structure named 'Afra' (meaning overflow) is often built to discharge surplus water.

The water revolution started by johads in Gopalpura, Alwar District, then extended to other villages. The Tarun Bharat Sangh (TBS) has been instrumental in supporting the construction of over 5,000 johads in Rajasthan's districts of Alwar, Dausa, Bharatpur, Sawai Madhopur, and Bikaner.

Kunds in Rajasthan

A "kund" / "kundi" resembles an inverted cup placed inside a saucer. These constructions are utilized in the Thar Desert in western Rajasthan and some parts of Gujarat. A kund is a round underground well with a catchment area that slopes towards the centre where the well is situated. The sides of the well are covered with lime and ash, and most pits have a dome-shaped cover, or at least a lid, to protect the water. Water from a kund can be drawn out with a bucket. The depth and diameter of the well depend on its use. The efficacy of a kund system is based on site selection and catchment factors (Ruhela, Bhutiani, & Anand, 2004).

Tankas in Gujarat

Tankas are conventional small underground well that are seen in some Gujarati dwellings. They are constructed in the courtyard of a home and were used to collect rainwater. They were spherical holes in the ground adorned with fine polished lime. Tankas were elegantly decorated with tiles in order to keep the drinking water cool. In case of less than normal rainfall in a given year, water from other adjacent sources was used to fill the family tanks. The tanka system is also seen in the pilgrim town of Dwarka, some dharamshalas as well as temples, where it has been practiced for generations.

Tanks and Anicuts in Andhra Pradesh

In Andhra Pradesh, tanks—some of which date back to the 14th century—were the main irrigation technique until the middle of the 1960s. The hills around this region are dotted with many small streams and rivers, which have traditionally been utilized for irrigation of crops using in embankments or tanks that receive water from the streams. Many streams in the Vishakhapatnam district originate in the Eastern Ghats and flow either into the Godavari or the sea. It has been documented that dams, built out of brushwood and weed, were usually constructed across streams, directing floodwaters either into fields or diverted into storage tanks. The principal rivers employed for watering of crops in the plains were the

Varaha, Sarada, Nagavali, and Suvarnamukhi. There were several old and traditional dams, known as anicuts, on the said rivers. The deltas of Krishna and Godavari rivers rely heavily on river systems for irrigation. As a result, irrigation in Andhra Pradesh's coastal plains was and is even today mostly focused on utilization of tanks and anicuts (Latika, 2012).

The phad system in Maharashtra

The phad irrigation system, which was maintained by the communities found in northwestern Maharashtra, most likely originated 300-400 years ago. In this arrangement, the command area is divided into smaller zones known as phads. It was performed in areas of Maharashtra's Dule and Nasik districts and is still used in some places today. The system consists of a series of bandharas (diversion weirs) placed on rivers to divert water for agricultural purposes. Each separate phad system consists of a dam (bandhara), a tiny canal (kalva) on the bank, and irrigation distributaries (charis). Canals (kalvas) were excavated to bring water into the fields and distributaries, and they were connected to various regions associated with the phad (Sarma & Aggarwal, 2023). Sarngs are field channels that transport water to particular cultivated lands. Sandams, or escapes, are used to drain extra water.

The phad system has created an exceptional social framework for managing water utilization by distributing water to all farms from head to tail. The farmers at the top receive irrigation water early and in abundance. The bottom farms use the excess flow. To ensure that all farms are properly supplied, farmers at the top are not allowed to water again until all farmers throughout the canal have gotten irrigation water.

Katas in Orissa

Orissa had a long practise of water harvesting. The "katas" were the chief irrigation systems in the earliest ancestral empire of the Gonds (today in Orissa and Madhya Pradesh). Most of these katas were constructed by gountias, or village headmen, who acquired territories from the Gond kings. Land here is divided into four categories based on its topography: aat (highland), mal (sloped land), berna (middle land), and bahal (lowland). A kata is built north to south, or east to west, of a community. A sturdy clay dam, curved at both ends, is constructed across a drainage line to support an irregularly formed sheet of water. Near one end of the embankment, there is a cut high up on the slope from which a small canal transports water to the fields. Due to moisture from percolation, irrigation was not necessary during years with typical rainfall; instead, the surplus flow was channeled into a nallah. However, during seasons with lesser rainfall, the core of the tanks was occasionally amended so that the lowest land could be irrigated (Latika, 2012).

Teluparagis and Kere in Karnataka

A range of technologies were used in Karnataka's traditional water harvesting for irrigation, including wells and springs known as teluparagis, tanks supplied by river channels, water obtained directly from river channels, and a series of tanks situated in river and stream valleys.

Teluparagi is a practice employed by farmers when there is no rainfall. In the center of the tank, a circular space is delineated and a raised bund is constructed. Telukaluve, or shallow waterways, are formed inside teluparagi and are only utilized for daily purposes. When the tank is full, telukaluves are used to release water from the lateral edges of the tank, supplying irrigation water to neighboring plants.

Tanks, known as 'kere', were the most common traditional irrigation technique in the Central Karnataka Plateau. They were fed by streams in valleys or by channels that branched off of anicuts built across streams. The excessive flow from one tank fed the next as the tanks were erected in series and this ensured no water was wasted (Hazarika, 2023).

Zing

These are small tanks, popular in Trans Himalayan regions like Ladakh, that collect melted glacier water through channels (Sharma & Mir, 2000). The Chuspon, is a traditional water manager or official in Ladakhi villages who controls the release and distribution of water stored in sources like Zings to the village's agricultural fields. He follows a strict irrigation schedule to ensure every farmer gets an equitable share (Kumar, Angchuk, & Namgyal, 2022).

Kul

The Kul system is a traditional water conservation and water channels found in the mountainous regions of Himachal Pradesh, particularly in areas like Spiti, Kinnaur, and Kangra. These gravity-fed irrigation channels, known locally as Kuhls, have been integral to sustaining agriculture in these arid terrains for centuries. They resemble tiny canals that transport water from a larger body to the fields. Water is transported from the main kuhl to the communities and fields by smaller drains, which are now often made of cement. Pucca or kachcha gates are built at regular intervals throughout their length to control water flow. These gates are usually opened and closed according to a predetermined timetable.

Cone-shaped scree slopes, alluvial fans, and river terraces are the primary locations for the Kuhl irrigation system. In order to stabilize slopes with trees and fodder crops, the upper portions of scree slopes and alluvial fans are usually farmed first (Ashraf & Iqbal, 2018). Irrigation, development, maintenance, and repair of kuhls are typically handled by community institution (jirgas). The jirga calculates and distributes water rights based on the community's land area when new irrigation channels are installed (Bilal, Haque, & Moore, 2003).

Naula

A common surface-water harvesting technique in Uttaranchal's hill regions is naula. Water is collected in these tiny wells or ponds by building a stone wall across a stream (Sarma & Aggarwal, 2023).

Gul

Gul is mostly a system for diverting and supplying water, rather than storing it. Gul are tiny channels that emerge at a source and then are redirected to fields. Nowadays, Guls are permanent structures made of stone masonry (More, 2020).

Dhara

Dhara is a simple spring source. In Uttarakhand, this tradition included beautiful characteristics such as a lion's mouth and a bull at the spring's mouth. Such Dhara can be found near temples and major transportation hubs like bus stations (More, 2020).

Khatri

Khatri are constructions having dimensions of 10x12 feet and six feet deep carved out in the hard rock mountain. These are seen in Hamirpur, Kangra and Mandi districts of Himachal Pradesh. There are two types of khatri: one for animals domestication in which rainwater is collected from the roof through pipes, and the other used for human consumption in which rainwater is collected by seepage through rocks (Sarma & Aggarwal, 2023).

Ahar Pynes

It is a conventional flood water harvesting technique in south Bihar that utilizes land slopes. Waterbodies in these areas swell only during the rainy season, but the water is swiftly removed or seeps into the sand. An ahar is a quadrilateral soil-filled attachment basin with three-sided embankments, constructed at the termination of tiny pynes. Both ahars and pynes transport water throughout the monsoon. Pynes are engineered channels built to use river water in arable lands (Dhiman & Gupta, 2011).

Virdas

Virdas are shallow pits formed by the sands of dry riverbeds and lakes to collect drinking water. These constructions are commonly found in Gujarat's Rann of Kutch. This location has typical topography, with undulations and depressions in the earth. Freshwater remains in the upper layer of Virdas, but saline water remains below the freshwater zone because to its higher density. The harvesting system is dependent on the nearby areas' grass cover, which is required for free infiltration of groundwater. The native nomadic people (Maldharis) built these one-of-a-kind structures in Gujarat Kutch (More, 2020).

Zabo

The zabo (which means 'impounding run-off') technique is used in Nagaland, north-eastern India. Kikruma, for example, is perched on a steep ridge and is still home to zabos. The area experiences heavy rainfall which travels down the slope, passes through several terraces and is collected in pond-like structures in the intermediate terraces; below are cow yards, and nearer the bottom of the hill are paddy fields (Sharma, Prasad, & Sonwal, 1994)

Cheo-ozih

Seen in the Kwigema village of Nagaland where the river Mezii flows. A stretched channel brings the river's water down. Many branch channels emerge from this waterway, and water is recurrently transferred to the terraces using pipes made up of bamboo (Agarwal & Narain, 1997). One of the channels is named Cheo-ozih; ozih means water, and Cheo was in charge of laying the 8-10 km-long waterway with its several branches.

Bamboo Drip Irrigation

Meghalaya is adept at using amazing technique for using bamboo pipelines to water farms. This method, dating back to 200 years, is utilized by farmers of old tribes in the Khasi and Jaintia hills for irrigating their black pepper crops using drip techniques. Bamboo pipelines are used to direct perennial springs on hilltops to the lower reaches via gravity. The bamboo channel sections redirect and transmit water to the sites, well is disseminated into divisions, laid out in succession with different forms and sizes of bamboo pipes. The water distribution process involves four to five phases from diversion to application (Dhiman & Gupta, 2011).

Bengal's inundation channel

Bengal previously possessed a remarkable network of inundation canals. The canals were extensive and shallow, carrying the waters from overflowing river; they were rich in fine clay but were devoid of coarse sand; they were lengthy and uninterrupted, parallel to each other, and at the appropriately distanced from each other. They were utilized for irrigation purposes, accomplished through sluices in the canal embankments (Sarma & Aggarwal, 2023) .

Baolis or Stepwells

Baolis were secular buildings from which anybody might collect water. Gandak-ki-baoli (so named because its water contains gandak, or sulphur) was constructed during the time of Sultan Iltutmish. The water from this stunning rock-hewn baoli is still utilized for washing and bathing. These stepwells usually comprised of a vertical shaft to draw water from it and the surrounding inclination to provide access to well. The galleries of the chambers around these wells were beautifully embellished and were usually cool and quiet, serving as a treat during warm weathers (Davies, 1989)

Kuis/ Beris

These 10 m deep holes were created parallel to tanks for collecting outflow and can be seen in western Rajasthan. Kuis can also be used to gather rainwater in areas with low precipitation. The mouth of the pit is usually very contracted. This prevents the collected water from evaporation. The crater expands as it digs underground, allowing water to percolate into a huge surface area (Hussain, Husain, & Arif, 2014). The apertures of these fully earthen constructions are typically sheltered with wooden boards or kept locked. Water is utilized judiciously, mainly during extreme situations ((CGWA), 2011).

Nadis Jhalaras

These were artificially constructed tanks found in Rajasthan and Gujarat that were chiefly intended for community use and sacred activities. Jhalaras are step-wells, typically four-sided, with stairs on three or all the verges (More, 2020). The most ancient jhalara is the Mahamandir Jhalara, which is as old as 1660 AD ((CGWA), 2011). Jhalaras Nadis are rural ponds located near Jodhpur, Rajasthan. They are used to harvest water from a neighbouring natural catchment during monsoon. The site of construction is based on the location of existing natural catchments and water harvest potentials. The position of the nadi has a

significant impact on its storage capacity because to the associated catchment and runoff characteristics (Sarma & Aggarwal, 2023).

Tobas

Tobas is the indigenous name for a earthen reservoirs with a natural catchment area. Tobas were built on a hard, low porosity tract of land that had a depression and a natural catchment region. Their renovation and management is vital to make sure they serve for a long duration with utmost efficiency. The pros of Tobas is their ability to collect and store water and replenish groundwater so that they can be utilized for human consumption. They are economical enough to be built and maintained by local communities. However, there are also some underlined problems associated with them. Their dependency on downpour can render them inefficient due to drying up. Also, if the construction isn't properly planned, the entire structure might collapse (Kumawat, Matwa, Anand, Gupta, & Sapre, 2023).

Khadin

A khadin, also known as a dhora, is a structure meant to harvest surface runoff water for agricultural use. The major characteristic is a very lengthy (100-300 m) clayey embankment established over the lower hill slopes that lie underneath uplands consisting of gravels. The khadin soils can uphold moisture for relatively greater period of time and thus inhabit soil microbes which in turn increase soil fertility. It was outlined for the first time by the Paliwal Bhramins residing in Jaisalmer during the 15th century (Mishra, 2011)

SazaKuva

Sazakuva, an open well with many owners (saza = partner), is the most significant source of irrigation in the Aravalli hills of Mewar, eastern Rajasthan. The earth taken out for the well pit is utilized to build a large round base or a raised platform inclining away from the well (Sarma & Aggarwal, 2023).

Rapat

A rapat is a percolation tank with a bund to collect rainwater flowing across a watershed and a waste weir to dispose of excess flow (Jethoo & Poonia).

Cheruvu

Cheruvu are found in Chittoor and Cuddapah districts in Andhra Pradesh. They are reservoirs to store runoff (Sarma & Aggarwal, 2023).

Eris

These (tanks) supply water to around one-third of Tamil Nadu's irrigated region. Eris have played various essential roles in maintaining natural balance, including flood control systems, reducing soil erosion and discharge waste during heavy rainfall, and recharging groundwater in the surrounding areas (Sarma & Aggarwal, 2023).

Temple ponds

Water is a symbol of spiritual significance for many religions. There are a number of myths and legends that fabricate of the gods being its presiding deities. These realizations made man safeguard the water resources and maintain them as a blessing of gods. Such traditional excavations were claimed to be dug up by deities and sages and were believed to have supernatural powers. Thus, they became famous as holy water- places.

Water management in temples

Tamil nadu

As in Southern parts of India the settlements were located near temples, therefore conventionally the temple tanks were the pivot of all activities. At the end of the monsoon festivals were held around these tanks. A temple, known as neerazhi mandapam, situated in the centre of the tank, would house the deity during those festivals.

These tanks, known as eris, are widespread throughout Tamil Nadu. They have ridges on three sides while one side is left open for the water flow. The water stored is disbursed through conduits. Water is fed into the tank from its catchment area by a feeder channel and the bund is reinforced by growing trees on it. Eris maintain ecological harmony as they control floods, prevent soil erosion and wastage of runoff during periods of heavy rainfall as well as recharge the groundwater.

Andhra Pradesh

Agriculture in Southern India was traditionally based on small- scale irrigation. Despite the significance given to agricultural advancement, none of the empires from 9th-16th century in South India set up department of irrigation. These activities were taken care of by common people, village organizations and temples. The Shaivite temple of Kalahasti, near Tirupati and The Tirupati temple in the Vijayanagar Empire used devotee grants to dig up irrigation channels and to refurbish temple lands (Latika, 2012).

Karnataka

Early Vijayanagar inscription from Mysore records that the state and the temple officials exempted from tax the land irrigated by a temple tank. The tank was constructed with the funds given by a local merchant. The merchant was given the income from this land for two years after which the land and the tank returned to the temple. However, a share of land the merchant retained as his “dasavanda” (payment in land for services rendered) for constructing the tank.

Causes of decline in traditional water conservation systems

As we are progressing towards advancement of hydrological engineering and scientific technological upliftment, we tend to seek innovations from modern sophistications. This has not only led to a decline in our belief in traditional water conservation techniques but also unnecessarily complicated the ancient mechanisms to do so. The negligence of the government and policy makers towards these resources have played a major role in lowering down their popularity among common people. Also the race towards

utilization of energized systems to exploit aquifers is also one of the main serving reasons. Besides, the lack of interest in construction and maintenance of such structures by village committees, organizations and individuals have further led to deterioration in these ancient practices making the lost in the run.

Conclusion

The current scenario of water conservation does not paint a fair picture forcing us to shift substantially towards our traditional roots where water conservation has been practiced since ages without any intricate machinery. A major advantage of such inclination towards traditional water conservation practices is their low cost and simplicity making them a suitable solution in areas with limited resources and moderate financial crunch. Ideally as these practices are in tandem with the natural settings therefore, they do not cause any environmental nuisance. However, there are some limitations associated with them like they demand continuous maintenance and renovation and require upgradation to work at their utmost potential. Thus, an integrated approach like combining the traditional knowledge with modern innovative incorporations is the need of the century so as to prevent these traditions from dying alongwith conserving water in the most practical way possible.

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