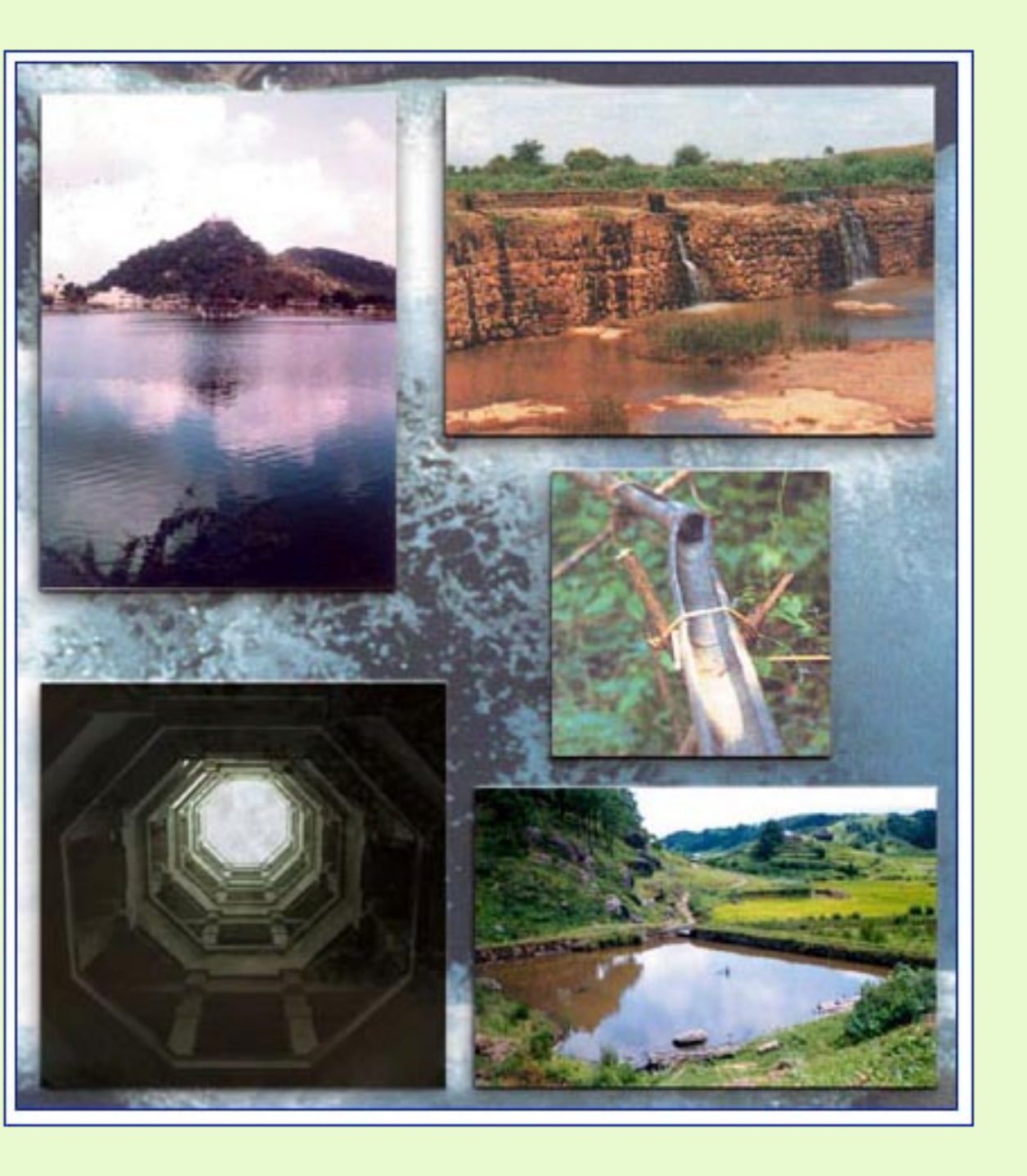
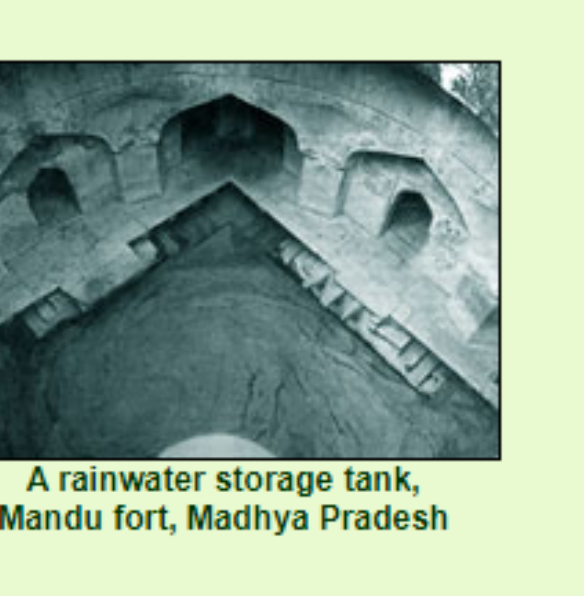
TRADITIONAL WATER HARVESTING SYSTEMS OF INDIA




A rainwater storage tank, Mandu fort, Madhya Pradesh

Despite being crisscrossed by a complex network of rivers, vast stretches of India have neither river nor lake to depend on. Rainwater is the only copious and clean source of water, but its distribution is neither uniform nor assured in all parts. India receives about 400 million hectare metres (mham) of rain per year over an area of 329 mha. The rainfall ranges from as low as 100 mm in the Thar Desert to 15,000 mm in the North east.

The history of India tells us that floods, droughts or both were a perennial occurrence. If the overflow of rivers and streams in spate could be redirected and stored, the water could be used during drought. Even rainfall as low as 100 mm, if harvested properly, can meet the drinking water needs of the people.

India's rich tradition of water harvesting systems

The practice of harvesting rainwater dates back to Vedic times when the need to create water sources that would remain both clean and provide plentifully was recognized.

Rivers were the obvious location of civilizations, and different civilizations utilized them in different ways. Early people cut channels, diverted rivers, and farmed their regions. Wells had been dug in the cities of the Indus – Sarasvati Valley by the third millennium B.C., while the "Great Bath" was probably a water storage tank. The Indus Valley cities had excellent systems of water harvesting and drainage. Dholavira, laid out on a slope between two storm water channels, is an example of sophisticated engineering.

Water harvesting down the ages

3rd millennium B.C.	Dams built of stone rubble were found in Baluchistan and Kutch
3000 – 1500 B.C.	Indus - Sarasvati Civilization had several reservoirs to collect rainwater runoff. Each house had an individual well
321 – 291 B.C.	Archeological evidence for dams, lakes and irrigation systems in the time of Chandragupta Maurya's rule
3rd Century B.C.	Kautilya's Arthasastra mentions irrigation using water harvesting systems
1st Century B.C.	Sringaverapura near Allahabad had a sophisticated water harvesting system using the floodwaters of the Ganges
2nd Century A.D.	Grand Anicut or Kallanai built by Karikala Chola across the river Cauvery to divert water for irrigation is still functional
11th Century A.D.	King Bhoja of Bhopal built the largest artificial lake (65,000 acres) in India fed by streams and springs
12th Century A.D.	Rajatarangini by Kalhana describes a well- maintained irrigation system in Kashmir

Tanks in the Indus – Sarasvati Valley

The excavations at Harappa and Mohenjodaro reveal deep rectangular constructions that were probably the earliest tanks built in India.

Ancient engineering feat

The excavated Sringaverapura tank

A tank excavated at Sringaverapura near Allahabad, Uttar Pradesh, dates back to the 1st century B.C. Rama began his 14 year exile from here and could well have drunk water from this tank. Excavations have unearthed a fully brick lined tank that is 800 feet long, 60 feet wide and 12 feet deep. The natural slope of the land was taken advantage of to bring water from the river Ganga to the tank by a nullah. The water first passed through two deep earthen tanks, where the silt settled down, and escaped through the upper end of the settling tank. The inlet to the main tank ended in steps with curved walls to slow down the water. Several wells were also dug in the bottom of the tank to ensure adequate water supply in the dry months.

The technology of water harvesting

Rainwater, runoff and the floodwaters from rivers were all harvested. Water harvesting systems were located

- in the open to capture rainwater where it fell
- in the path of a stream or its runoff
- beside rivers to catch the flood waters

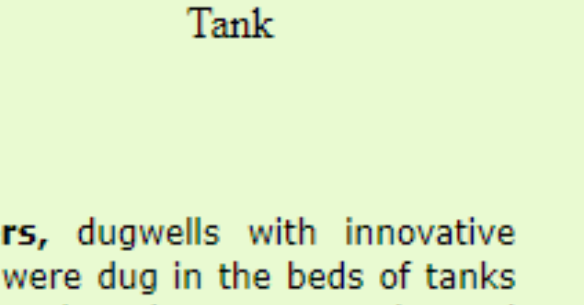
The design and structure of each system was decided by the terrain and rainfall pattern of the region. Hence each eco-zone of India had unique techniques for harvesting water.

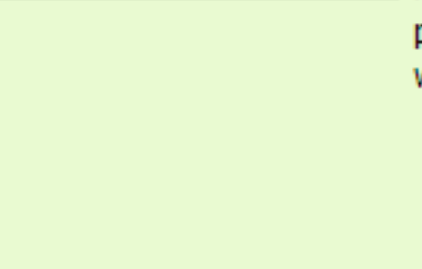
a. In the **hills and mountainous regions** where there are plenty of streams, simple engineering structures were used to divert the water into channels that fed the fields. The structures became more sophisticated and much bigger when the streams turned to rivers.

b. In the **arid and semi-arid regions,** where the streams are more seasonal, the diversion channels first led the water to a storage structure like a tank for later use. Storage systems to collect just runoff from the watershed were also built.

c. In the **flood plains,** several unique systems to control and harness the floodwaters were devised.

d. In the **coastal areas** where there is danger of river water turning saline, several ingenious ways came up to regulate the flow of saline water.


Tank



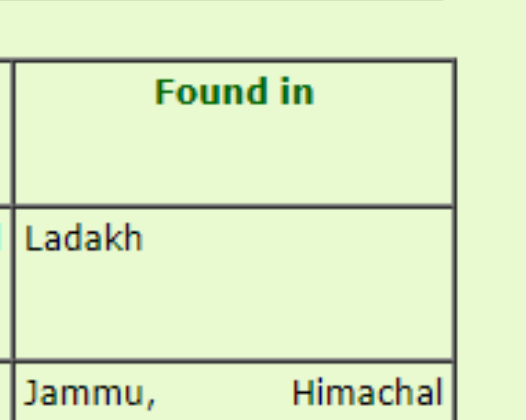
e. In regions with good **groundwater aquifers,** dugwells with innovative methods to lift the water were in use. Deep wells were dug in the beds of tanks and rivers, both to serve as a source of good water when the water recedes and also to recharge the groundwater when they are fully submerged.

f. In areas where **rainfall is the only option,** people devised methods to literally "catch rainwater where it fell".

Advantages of harvesting water

When a small waterbody or source is created, there are several benefits.

- The standing water percolates into the ground and recharges the water table
- Wells in the surrounding areas have plenty of good water
- Green cover increases in the surrounding areas
- Soil erosion is reduced
- Silting of rivers is reduced
- Floods and runoff get controlled



Eco-zone	Traditional water harvesting systems	Description	Found in
1. Trans-Himalayan Region	Zing	Tanks for collecting water from melted ice	Ladakh
2. Western Himalayas	Kul	Water channels in mountain areas	Jammu, Himachal Pradesh
	Naula	Small ponds	Uttaranchal
	Kuhl	Headwall across a ravine to divert water from a natural stream for irrigation	Himachal Pradesh
	Khatri	Chambers carved in hard rock for storing water	Himachal Pradesh
3. Eastern Himalayas	Apatani	Terraced plots connected by inlet and outlet channels	Arunachal Pradesh
4. Northeastern Hill Ranges	Zabo	Impounding runoff	Nagaland
	Cheo-oziihi	Channels from rivers	Nagaland
	Bamboo drip irrigation	Water from streams in the hills is brought to the plains via bamboo pipes for drip irrigation	Meghalaya
5. Brahmaputra Valley	Dongs	Ponds	Assam
	Dungs / jampois	Small irrigation canals linking rice fields and a stream	W. Bengal
6. Indo-Gangetic Plain	Ahar-pynes	Embanked catchment basin and channels	S. Bihar
	Bengal's inundation channels	Inundation canals	W. Bengal
	Dighis	Small square or circular reservoir fed by canals from rivers	Delhi
	Baolis	Stepwells	Delhi
7. Thar Desert	Kunds / kundis	Underground storage	W.Rajasthan
	Kuis / beris	Deep pits near tanks	W.Rajasthan
	Baoris / bers	Community wells	Rajasthan
	Jhalaras	Tank	Rajasthan, Gujarat
	Nadi	Village ponds	Jodhpur, Rajasthan
	Tankas	Underground tank	Bikaner, Rajasthan
	Khadins	Embankment across lower hill slopes	Jaisalmer, W. Rajasthan
	Vav / Vavdi / Baoli / Bavadi	Stepwells	Gujarat, Rajasthan
	Virdas	Shallow wells	Rann of Kutch, Gujarat
	Paar	Area where water has percolated, accessed by kuis	-
8. Central Highlands	Talab / Bandhis	Reservoirs	Bundelkhand, Madhya Pradesh
	Saza Kuva	Open well	Mewar, E. Rajasthan
	Johads	Earthen check dams	Alwar district, Rajasthan
	Naada / bandh	Stone check dam	Mewar, Thar desert
	Pat	Diversion bund across stream	Jhabua district, Madhya Pradesh
	Rapat	Percolation tank	Rajasthan
	Chandela tank	Tank	Rajasthan
	Bundela tank	Tank	Rajasthan
9. Eastern Highlands	Katas / Mundas / Bandhas	Earthen embankments across drainage lines	Orissa & Madhya Pradesh
10. Deccan Plateau	Cheruvu	Reservoirs to store runoff	Chitoor,Cuddapah districts of Andhra Pradesh
	Kohli tanks	Tanks	Maharashtra
	Bhandaras	Check dams	Maharashtra
	Phad	Check dams and canals	North western Maharashtra
	Kere	Series of tanks	Central Karnataka
	Ramtek Model	Intricate network of groundwater and surface waterbodies, connected through surface and underground canals	Ramtek, Maharashtra
11. Western Ghats	Surangam	Horizontal well	Kasargode, Kerala
12. Western Coastal Plains	Virdas	Shallow wells	Rann of Kutch, Gujarat
13. Eastern Ghats	Korambu	Temporary wall of brushwood, grass and mud laid across channels to raise the level of water	Kerala
14. Eastern Coastal Plains	Yeri	Tank	Tamilnadu
	Ooranis	Pond	Tamilnadu
15. The Islands	Jackwells	Bamboo pipes are used to lead water into shallow pits	Great Nicobar Island

Traditional water harvesting – from Kashmir to Kanyakumari

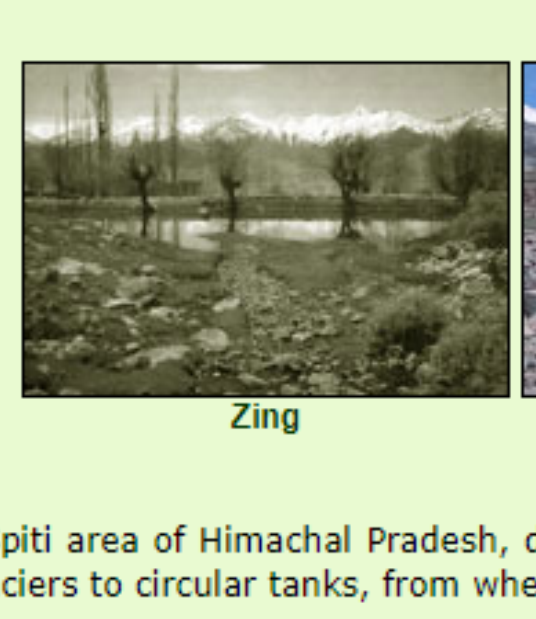
Throughout India, several ingenious ways have been devised to catch and store rainwater for future use. They are known as traditional water harvesting systems. It is the traditional water harvesting systems that have made life possible even in the Thar Desert.

The technology and engineering of the traditional water harvesting systems differed, depending on whether they were to provide drinking water or to be used for irrigation. Those meant for drinking water were generally smaller, sometimes covered and with steps leading down to the water. This ensured that people could only collect water manually in small quantities to meet their individual or family's needs. Irrigation systems on the other hand spread over large open areas and had a complicated network of pipes and channels for collecting and distributing water.

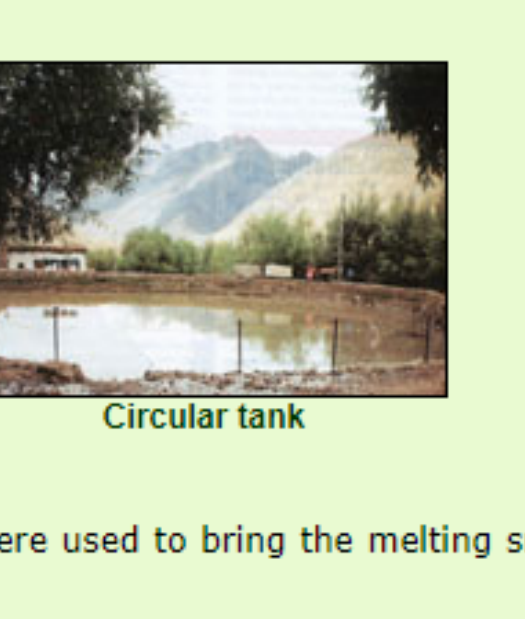
Trans Himalayan Region

Water from melting snow and ice is the only source of water here.

Nearly 68% of Ladakh lies above sea level. Even the Thar desert gets more rainfall. The melting snows and glaciers are the only source of water. The people made intelligent use of their limited resources and made agriculture possible in this dry and barren land. The snow and ice melt slowly through the day and water is available in the streams only in the evening, when it is too late for irrigation. The water in the streams was hence led by channels to storage tanks called ***zing*** and used the next day.


Zing

Kul


Circular tank

In the Spiti area of Himachal Pradesh, diversion channels called ***kul*** were used to bring the melting snows from glaciers to circular tanks, from where the water was distributed.

Western Himalayas

The farmers of this region built canals along the contours to collect water from hill streams, springs and melted snow.

Since the first millennium A.D., there has been extensive rice cultivation in Kashmir, aided by an elaborate irrigation system consisting of irrigation canals bringing water from the melting snows. Water wheels (araghatta) were used to lift water from the Jhelum.

Ponds were the main source of drinking water in Jammu. Ponds in the Kandi region were dug beside rivers. During floods the riverwaters were diverted into them.

In Himachal Pradesh a temporary headwall of boulders called kuhl was constructed across a ravine to divert the waters of natural flowing streams (khud) through a canal to the fields. About 20 ha could be irrigated by a community kuhl. The water would flow from field to field and surplus water would drain back to the khud. The kohli or water tender distributed and managed the water.

In Uttar Pradesh contour channels called ***guhls*** were used extensively. Streams were dammed by temporary barriers to divert water into these channels.

Guhl

Eastern Himalayas

Streams are the only dependable source of water here. Bamboo pipes are used to divert the water for irrigation.

The apatani system of Arunachal Pradesh was practiced by the Apatani tribes. They harvested both ground and surface water for irrigation. The stream water was blocked by constructing a wall 2 to 4 m high and 1 m thick near forested hill slopes. This water was taken to the agricultural fields through channels. The valleys were terraced into plots separated by 0.6 m high earthen dams with inlet and outlet channels (to the next plot) that help to flood or drain the plots as and when required.

Northeastern Hill Ranges

Rainfall and groundwater are the main sources of water in this region. But the terrain makes it difficult to capture the surface water. Natural springs are used for drinking water purposes.

Zabo, meaning 'impounding run-off', is practiced in Nagaland. When rain falls on terraced hill slopes, the runoff collects in ponds in the middle terrace. The runoff then passes through slopes where there are cattle yards, and finally reaches the paddy fields at the foot of the hills.

Bamboo drip irrigation, Meghalaya

Rapidly flowing water from streams and springs was captured by bamboo pipes and transported over hundreds of metres to drip irrigate black pepper cultivation in Meghalaya. Many bamboo pipes of varying diameters and lengths were laid to manipulate and control the flow of water.

Brahmaputra Valley

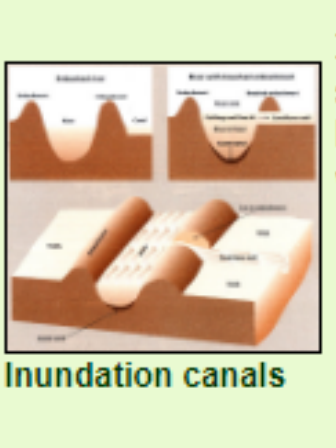
This region has many natural depressions along the banks of the Brahmaputra and Barek rivers. Floodwaters accumulate in these depressions, which are used for cultivation when the waters recede.

Dongs or ponds were constructed by the Bodo tribes of Assam to harvest water for irrigation. In the Jalpaiguri district of West Bengal, small irrigation channels called dungs or jampois were used to bring water from streams to rice fields.

Indo-Gangetic Plains

The rivers and their floodwaters are the main source of water here.

Ahar-pyne is a traditional floodwater harvesting system indigenous to south Bihar. Here the terrain has a marked slope, the soil is sandy, groundwater levels are low and rivers flood their banks only during the monsoon. The ahar is the catchment basin embanked on three sides, while the fourth side is the natural slope. Pynes or artificial channels start out from the river, and meander through fields to end up in an ahar.


Inundation canals

Inundation canals were an efficient irrigation system in Bengal. Floodwaters rich in silt entered the inundation canals, and were carried to the fields. The canals were broad and shallow and long and continuous. Channels cut into their sides distributed water to the fields. They were closed once the floods ceased.

Thar desert

The Thar Desert receives very little rainfall. Hence rainwater was captured and stored in ponds and underground tanks.

Tarais (reservoirs) were built in the valley between sand dunes by constructing bunds at the two ends. When it rained the rainwater collected in the reservoir. The tarais dried up in a few months owing to the highly porous soil. But the region around it remained wet and moist. Wells were usually dug close to the tarai.

Individual homes and farms in Bikaner built **tankas**. They were round or rectangular underground rooms that functioned as water tanks. Rainwater from the roof or terrace were directed towards an opening in the floor which led to the tanka.

Stepwells are India's most unique contribution to architecture. They are called vav or vavadi in Gujarat, and baolis or bavadis in Rajasthan and northern India. The stepwells of Gujarat consist of a vertical shaft in the middle from which water is drawn. This shaft is surrounded by corridors, chambers and steps which provide access to the well. They were profusely carved and served as a cool resting place in summer.

Mata Bhavani's vav at Ahmedabad, built in the eleventh century, is one of the earliest stepwells, while the Rani Vav (Queen's well) at Patan, built during the late eleventh century, is the grandest. The Dada Harir's vav at Ahmedabad, and the octagonal vav at Adalaj, are some of the finest examples of stepwells.

Kunds or **kundis** in Western Rajasthan and Gujarat harvest rainwater for drinking in the sandy tracts of the Thar Desert. The saucer-shaped catchment area gently slopes towards the pit in the centre which has a dome-shaped cover, to protect the water. The water inlets are covered with mesh. The depth and diameter of kunds depend on their use (drinking or domestic water requirements).

Kuis

Kuis or **beris** were deep pits dug near tanks to collect the seepage. They were also used to harvest rainwater in areas with scanty rainfall. From a narrow mouth a kui gets wider to prevent evaporation of collected water but at the same time facilitates more water collecting.

Central Highlands

The region is full of ravines and valleys. Irrigation by wells and tanks was very common in this region. The natural undulations provide for creation of wells and lakes. Both Jodhpur and Udaipur in Rajasthan are dotted with innumerable lakes. There are small (talai), medium (talab) and large (sagar) lakes. Pichola, Fatehsagar and Udaisagar are Udaipur's main lakes. In Jodhpur efforts were made to catch every drop of rainwater by building tanks, lakes, ponds, wells and drainage canals.

The Chandela Kings (851 – 1545 A.D.) of Bundelkhand, Madhya Pradesh, established a network of several hundred tanks that ensured a satisfactory level of groundwater. They were constructed by stopping the flow of a nullah or a rivulet running between 2 hills with a massive earthen embankment. The quartz reefs running under the hills confined the water between them.

The Bundela Kings who came later used lime and mortar masonry and were bordered by steps, pavilions and royal gardens. The tanks were built close to palaces and temples and were not originally meant for irrigation at all, but for the use of all. Breaching of embankments and cultivation on the tank bed has destroyed many. But the wells in the command area of these tanks continue to yield well and also serve to recharge the groundwater.

A Chandela tank

Small earthen check dams called johads were built in Rajasthan to capture and conserve rainwater, improve percolation and groundwater recharge.

Eastern Highlands

The hilly country is broken by torrential streams. Not much is known about the water harvesting systems here.

The **katas, mundas** and **bandhas** were the main irrigation sources in the ancient tribal kingdom of the Gonds (now in Orissa and Madhya Pradesh). A kata is a strong earthen embankment, curved at either end, built across a drainage line to hold up an irregularly-shaped sheet of water. There is a cut high up on the slope near one end of the embankment from where water is led by a small channel from field to field along the terraces.

Deccan Plateau

The elevation ranges from 1000m in the south to 500m in the north. The rainfall is low to moderate. Many kinds of irrigation systems like wells, embankments across rivers and streams, reservoirs and tanks are all found here.

An amazing collection of 19,000 very small, big and large tanks bringing water to practically every house by a network of channels was in existence in the Bhandara district of Maharashtra. Built by a group of cultivators called Kohlis nearly 250 – 300 years ago, they irrigated about 25 percent of the land under crops. The tanks were built on the slopes of the Gaikhuri range. The larger tanks were on the higher slopes, while the smaller ones were placed in the foothills.

Check dams or diversion weirs called ***bhandaras*** were built by villagers across rivers in Maharashtra. They raised the water level of the rivers and made it flow into channels. Where a bandhara was built across a small stream, the water supply would usually last for a few months after the rains.

In Andhra Pradesh, where the annual rainfall is 1000 mm, large tanks called cheruvu were the main irrigation source. They were fed by streams. Anicuts were built across many rivers. Chain tanks were built in hilly regions with wide valleys. Several tanks were constructed starting from the height of the foothills to the floor of the valley. Canals that take the overflow from one to the next connected them. Each tank also received drainage from around its basin.

Bhandara, Maharashtra

Tanks called kere were the predominant traditional method of irrigation in the Central Karnataka Plateau. They were fed either by channels branching off from anicuts (check dams) built across streams, or by streams in valleys. The tanks were built in a series, usually situated a few kilometres apart. The overflow from one tank supplied the next all the way down the course of the stream. Many rivers were also dammed and channels for irrigation were provided.

Western Ghats

Surangam, a special water harvesting structure, is found in Kasaragod district in northern Kerala. People here depend on groundwater. A horizontal well was dug in hard laterite rock formations until water was found. The water seeped out of the hard rock and flowed out of the tunnel where it was collected in an open pit.

Western Coastal Plains

Shallow wells called virdas were dug in low depressions called jheels (tanks). They are found all over the Banni grasslands, a part of the Great Rann of Kutch in Gujarat. They were built by the nomadic Maldharis who identified these depressions by studying the flow of water during the monsoon. The virdas yield sweet potable freshwater in a region known for its saline water.

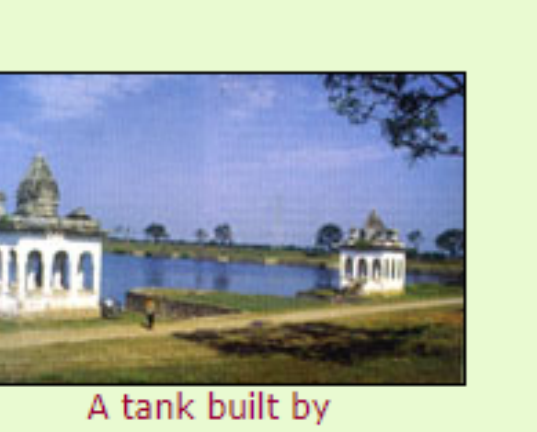
Eastern Coastal Plains

Being on the coast, Kendrapada district of Orissa suffers from waterlogging, floods or saltwater ingress. There are also a number of rivers, creeks and ponds. The solution was a community pond in each village, with huge bunds to stop saltwater ingress. Every house also had a pond in its backyard. The dug out earth was used to build a raised platform for the house. The backyard pond served as the source of drinking water and also took care of floodwaters. Adjacent ponds were linked to form a chain of ponds.

The Islands

The Shompen tribals of the Great Nicobar Island made full use of the undulating terrain to harvest water. In the lower parts, bunds of hard bullet wood were built and water collected in the pits called jackwells. A full length of split bamboo was placed along a slope. Rainwater flowed through it and collected in the pits. Bamboo pipes were placed under trees to collect the dripping water from the leaves. A series of increasingly bigger jackwells were connected by split bamboos to make sure the overflow from one was harvested by the next.

Tank irrigation


A tank built by Bhonsales by Nagpur

Tanks are the oldest source of water for irrigation. There are tens of thousands of tanks all over India. They are small reservoirs with earthen walls, used for storing water diverted from a stream or run off.

Tank irrigation in India is concentrated in

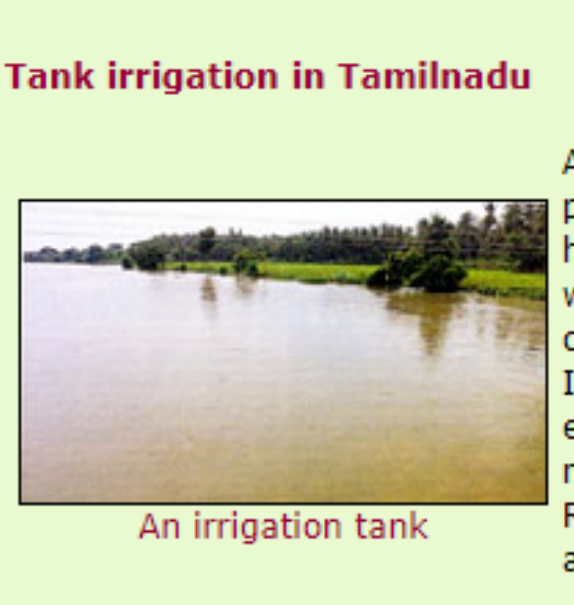
- Coastal Tamilnadu and Andhra Pradesh
- South Central Karnataka, Telengana and Eastern Vidarbha
- N.E. Uttar Pradesh (in the area of the former kingdom of Awadh)
- Rajasthan, east of the Aravalli mountains

Tanks or reservoirs are the most important source of irrigation in South India. Several ancient tanks are found here.

- Pampasagar tank in Bellary district near Tuungabadra river
- A series of tanks at different levels of a watershed (1096 A.D.) at Kattagiri
- Pakhal, Ramappa, Laknavaram and Sanigaram in Warangal and Karimnagar districts of Andhra Pradesh (12th and 13th centuries A.D.)

An 1856 study of irrigation in South India said "The extent to which tank irrigation has been carried throughout all the irrigation region of the Madras Presidency is truly extraordinary. An imperfect record of the tanks in the 14 districts shows them to amount to not less than 43,000 in repair and 10,000 out of repair or 53,000 in all."

Tank irrigation in Tamilnadu


An irrigation tank

As per a 1996 – 97 estimate, there are 39,202 tanks in Tamilnadu. In the past, Chennai alone had about 150 tanks. In Tamilnadu, tank irrigation has not increased much since 1883, when 50 percent of the cropped area was under tank irrigation. Today, less than 10 percent of the land under crops is irrigated by tanks, built mostly by the Chola and Pandya kings. Inscriptions in temples tell us of the largesse provided by the kings for establishing drinking and irrigation water sources. The construction and maintenance was however done entirely by the people. The Rajasmighamangalam tank of Ramnad was built more than 1000 years ago by the Raja of Ramnad.

The Number of Tanks in the Districts of Tamilnadu, 1996-97

Districts	Panchayat Union Tanks	PWD Tanks	Ex-zamin Tanks	Total
Chengalpattu	1,733	1,207	756	3,746
North Arcot	2,084	1,169	482	3,735
South Arcot	1,766	757	79	2,602
Salem	549	188	-	737
Dharmapuri	1,579	101	154	1,834
Coimbatore	64	59	-	123
Thanjavur	491	685	-	1,176
Pudukkottai and Trichy	5,334	268	214	6,394
Madurai	3,391	771	331	4,493
Ramanathapuram	1,333	1,508	7,367	10,208
Tirunelveli	965	686	445	2,096
Kanyakumari	1,074	984	-	2,058
Nilgiris	-	-	-	-
Total	20,413	8,903	9,886	39,202

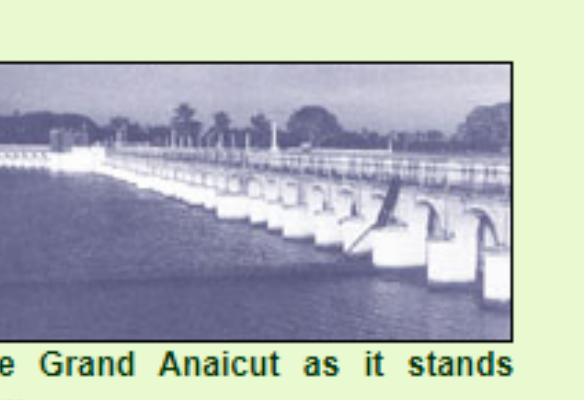
Courtesy: Palanisamy K. and Easter, K.W., Tank Irrigation in the 21st Century - What Next? Discovery Publishing House, New Delhi, 2000

Waterbodies in Tamilnadu fall under three categories: lakes or yeris, tanks or kulams and ponds or kuttais. A yeri was a large earthenware tank dug out of the ground with the dug out mud making the side walls or bunds. A kulam was built with bricks (and occasionally granite) and was attached to a temple, giving it the name kovil kulam or temple tank. A kuttai was a small pond. In Tamilnadu there are a few tanks that irrigate more than 1000 ha and even one which serves 6000 ha. Uranis are natural springs. Rectangular tanks are constructed above them to collect the water coming out from the ground. A winding staircase is provided for people to go down and collect the water for their domestic use.

The village community decided what crops to grow and where to grow them, how long the sluice gates of the yeris should be kept open, how much water should flow to each field and so on.

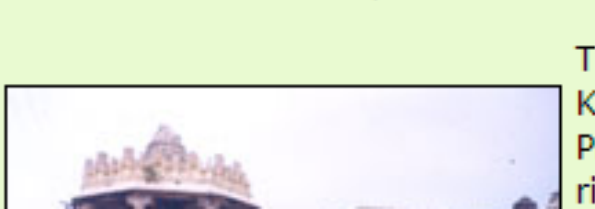
Tanks can be classified into system and non-system tanks. System tanks receive plenty of water as they catch the overflow from a reservoir, nearby stream and the runoff from around their catchment. They help farmers to raise more than one crop. Non-system tanks depend entirely on rainfall and can support only one crop. The tanks used a system of canals and sluice gates to control and transport the water. Several tanks linked by canals were also built in the watershed areas. The surplus of water in the higher tank thus flowed into the lower one, following the natural slope of the land.

Anicuts were small or medium dams built across rivers to divert water into irrigation channels. The Grand Anicut or Kallanai was built in the second century A.D. by Karikala Chola. It was made of stone and situated on the river Cauvery where the River Kollidam branches off. Anicuts have also been built across the Tambaraparani, Chittar and many others. The anicuts in the Kanyakumari district are said to have been built 1000 years ago.


The Grand Anaicut as it stands now

Temple tanks of South India

In South India, the tradition of establishing a tank alongside a temple prevails. Since every village has a temple, it also has a temple tank. These tanks were constructed to harvest water. They captured rainwater and runoff. Sometimes, channels were constructed to bring water from a nearby stream or river.



The temple tanks are known as kovil kulam in Tamilnadu, kulam in Kerala, kalyani in Karnataka and cheruvu or pushkarini in Andhra Pradesh. The water from the temple tank was mainly meant for the ritual bath of the deity and to provide water for the flowering plants in

Temple tank, Melkote, Mandya district, Karnataka

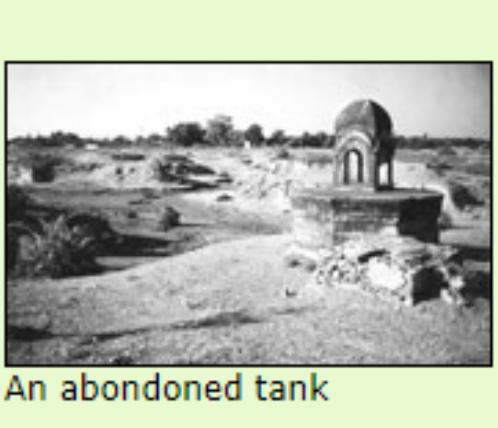
the nandavanam. Devotees also washed their hands and feet or even bathed in a separate tank maintained for that purpose before entering the temple. The temple tank was the focal point of several religious activities like the theppam or float festival, for the offering of prayers to one's ancestors and meditation on the banks of the tank.

The temple tanks vary in size and shape and are a masterpiece of engineering. Corridors and long flights of steps surround them. They have intricate inlet channels for bringing water from a stream or river and outlets that carry away the excess water. Some have natural springs in their bed and others have wells that can be accessed when the tank is dry. In ancient times the temple tank always had water, even when all other sources had dried up.

Water scarcity - a phenomenon of the 20th century

With time, the rivers flowing through the urban areas have dwindled into streams of garbage, and become dirty stinking cesspools where mosquitoes and bacteria breed. Today, all the water required for urban areas is piped in or transported from other areas.

To keep pace with the population growth, urbanization and the green revolution, big dams were seen as the ultimate solution to the water woes of a country faced by perennial drought, flood or both. Agriculture came to depend almost solely on canal water provided by reservoirs.


An abondoned tank

The construction of big dams struck a death knell for the traditional harvesting systems. With the Government stepping into provide water, the people's effort ceased. Harnessing and supplying water became the responsibility of the government. The rulers of the princely states and the zamindars were the most successful in developing minor irrigation systems through water harvesting. Tanks in particular were built almost solely during their time. They provided the resources, but it was the combined people's effort that went into building, maintaining and managing the distribution of water. In the colonial period, under the British rulers, community effort ceased. Thousands of traditional water harvesting systems fell into decline for want of proper maintenance and use. As a result,

- Tanks silted up, their embankments were breached and their beds were used for cultivation
- Wells fell into disuse and collected rubble and garbage
- Deforestation led to floods and soil erosion, which destroyed water harvesting structures
- Knowledge of traditional water harvesting systems was not put into practice or passed on to future generations.

But today, even with the large water projects, the problem of water famine continues. For several decades different parts of India have been in the grip of drought. Even as the serious problems accompanying changes in the natural course of a river are being realized, the big dams continue to be built: Tehri, Narmada and Alamatti are but a few.

Slowly, there is a growing awareness that the traditional water harvesting systems will be a better and cheaper alternative to big or small dams. Groups of villages have revived small water harvesting systems and are enjoying the benefits.

Some of the contemporary practices being adopted to harvest rain...

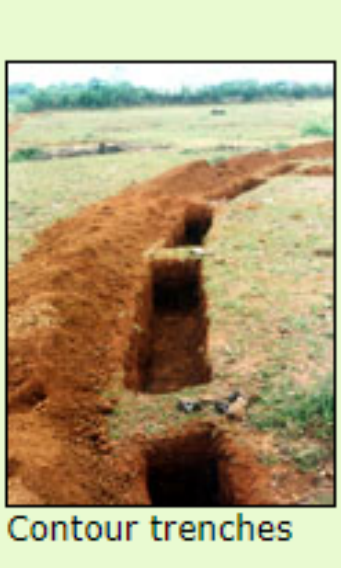
Check dams are constructed across small streams with high banks.

- The velocity of the runoff is slowed down and reduces soil erosion
- Soil moisture is improved by standing water and percolation recharges the aquifers

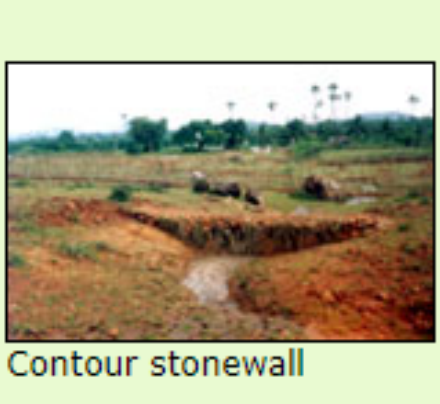
Contour trenches are dug on hill slopes and on barren wastelands for soil conservation through moisture retention. The trenches break the slope and reduce the velocity of surface runoff. The slopes can then be used for afforestation.

Bunds or small earthen barriers are built on sloping agricultural land. A long slope is converted into several short ones in order to

- increase the standing time of rainwater where it falls, thereby allowing it to percolate into the soil
- minimise velocity, thereby reducing the erosion caused by runoff
- divert runoff for water harvesting purposes


Contour trenches

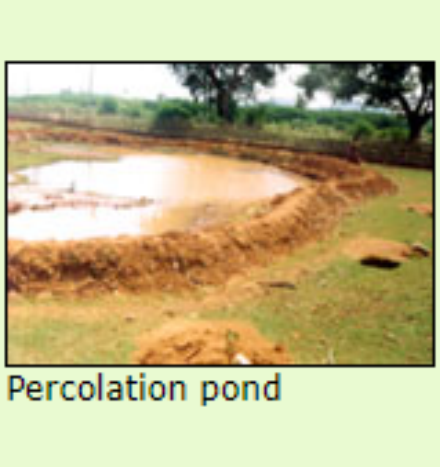
Contour stonewalls made of stones are built across a hill slope to intercept the runoff. Soil moisture is thus conserved and erosion is reduced.


Contour stonewall

Sub-surface dams or groundwater dams are constructed to obstruct the natural flow of groundwater and store it. They are used where groundwater flows vary from very high flows after the rain to very low flows in the dry season. When water is stored underground it reduces loss due to evaporation and is protected from contamination and parasites.

Percolation ponds like irrigation tanks have a bund to restrain the water flowing through a watershed, and a wasteweir for the surplus to flow through. Water percolating into the bund is lead downstream by drains under the bund.

Several local communities have modified traditional water harvesting practices to suit their domestic and irrigation needs.


Percolation pond

Artificial Glaciers

In Ladakh the water from melting glaciers reaches the fields only in summer. The people have hence channelised water through metal pipes to the shadow area of a mountain. This water freezes and being at a lower altitude and closer to the villages, it melts and reaches them in spring.

Nadis

In Rajasmand district of western Rajasthan, nadis (ponds) once served as the principal drinking water source. They received water from erratic, torrential rainfall. As large quantities of sediments were regularly deposited in them, they were destroyed by quick siltation. 20-30 nadis with a command area in excess of 500 ha. have now been constructed. Spillways have been added to prevent their damage by siltation. Afforestation of the drainage basin and construction of silt traps have helped further.

Polymer kunds

To deal with acute water scarcity in Churu District in Rajasthan, villagers are encouraged to build and renovate kunds (well-shaped tanks). The traditional materials like clay, silt, lime, ash and gravel used to make the catchment area of a kund are not completely impermeable, and hence some water is lost due to seepage. A water-based non-toxic polymer solution that permeates the highly porous sandy soil is now being used to increase runoff into the kunds. These materials reduce loss due to seepage of water into the soil.

Chauka System

In Jaipur, Rajasthan, degraded pastures have been dyked to form chaukas to harvest rain. Chaukas are rectangular plots arranged in a zigzag pattern and lie along a small gradient. 1.5 m high dykes are built along the three sides that lie towards the lower part of the gradient. Trees are also planted on the dykes to withstand rain.

When it rains, water collects in the dyked lower half of the chauka. As the water level rises in one chauka, it spills into the next and so on. The entire pasture hence receives water. The chaukas do not get flooded. The excess water from the last chauka flows into a drain. The chauka system also promotes recharge of groundwater.

Jaldhar Model

In the Eastern Highlands, rainwater is harvested in a portion of the farmland. Pits are dug in each plot (which is bunded) to accumulate water. This pit also helps the subsurface flow of water to lower plots and improves the soil moisture of the area as a whole.

Networking of farm ponds

In Adihalli watershed, in Arasikere taluka of Hassan district in Karnataka, 330 farm ponds have been excavated. A series of ponds, constructed along contour lines and connected to one another, allow easy access to water and better soil retention.

Community effort and traditional wisdom

Bhaonta-Kolyala village, Alwar district, Rajasthan: Every year, the villagers of Bhaonta-Kolyala poured water into a johad - a crescent-shaped earthen check-dam - on Deepavali. The new born and newly wed came to be blessed by the deity of the johad. On a moonless day, villagers engaged themselves in community work like building a temple or starting work on a new johad. But in the years that followed, the villagers started neglecting johads, which became buried under rubble. There were several droughts in the late 1970s and early 1980s, and there was no trace of water in the 25 wells in the village.

Rediscovering the johads

In 1986, the villagers of Bhaonta-Kolyala took the help of Tarun Bharat Sangh (TBS), a non-governmental organisation (NGO), organized themselves and started protecting forests and repairing old johads. In their aim "to catch each and every drop of rain water that fell on the village", they studied and mapped the natural drainage system and chose the best sites for building johads.

Today, the village has a total of 15 water harvesting structures, including a 244 metres long, 7 metres tall concrete dam in the upper catchment of the Aravalli to stop water before it flows downstream. The year after the completion of the dam, water level in the wells downstream rose by two to three feet. The percolation of water from this dam has benefitted villages 20 km downstream, whose wells have all filled with water now. Cultivation and milk production have increased.

Reviving the Arvari

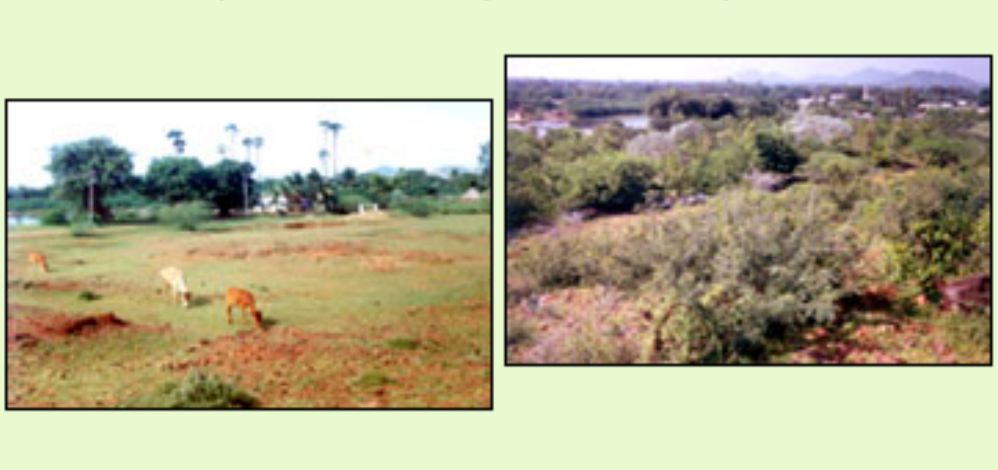
In 1990, when the villagers started constructing the big dam, they did not know that it was at the origin of the Arvari river. By catching and percolating water, the Arvari river flowed again and became a perennial river in 1995.

- The 70-odd villages in the Arvari basin have formed the Arvari River Parliament to protect the Arvari and to solve internal disputes.
- They also undertook afforestation of the adjoining forest area and declared it the Bhaironath Public Wildlife Sanctuary. Animals from the nearby Sariska Tiger Reserve forests have started migrating to this sanctuary.
- The villagers have restricted tree collecting to only branches for domestic purposes.
- Grazing is allowed only in specific parts of the forest. Recently, the villagers dug a pond on the periphery of the sanctuary for the benefit of the wild animals.

Even though rainfall has been scarce for the last three years, there is enough water for drinking and irrigation. The village community has shown that collective planning and management and adoption of traditional wisdom has solved their waterless plight and brought economic well-being as well.

Successful watershed management

Nenmeli, Kanchipuram district, Tamilnadu: At the centre of Nenmeli there are two ponds overlooked by a small hillock. The temple at the foot of the hill, owned the land between the hillock and the temple, which is the catchment for the rainwater coming from the hillock. In 1995, there was little or no water, as even rainwater rushed away, due to deforestation and removal of fertile topsoil for construction. With the onset of the rains, soil would be washed off the hillock and into the adjoining tank. Thus the tank was also silted up. The villagers approached CPREEC, Chennai to help them develop their watershed.


Nenmeli before and after water harvesting

- The hillock was contoured and bunded with locally available stones
- Low stone check walls were constructed to prevent water runoff
- The adjoining tank was desilted by the local people and CPREEC
- Trees were planted along the contour line, on the slopes of the hillock

Today, CPREEC's watershed development efforts have paid rich dividends. The groundwater level has come up and the once dry wells are now full, with at least 10 ft. of water through the hottest summers. A wasteland has become green.

The materials and illustrations used in this publication have been taken from the following:

1. Dying Wisdom, Centre for Science and Environment, New Delhi, 1997

2. Making Water Everybody's Business, Centre for Science and Environment, New Delhi, 2001

3. Tanks of South India, Ed. A. Vaidyanathan, Centre for Science and Environment, New Delhi, 2001

4. Tank Irrigation in the 21st Century - What Next?, Palanisamy K. and Easter, K.W., Discovery Publishing House, New Delhi, 2000

5. Survey of the Environment, The Hindu, 1994,2001,2002,2003

6. Survey of Indian Agriculture, The Hindu, 2000,2002

7. Sacred Tanks of South India, C.P.R. Environmental Education Centre, Chennai, 2002

Harvest each and every drop of rain, Catch it where it falls.