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Traditional Water Harvesting Methods in Rajasthan

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ABSTRACT: Rainwater harvesting is the simple process or technology used to conserve rainwater by collecting, storing, conveying and purifying of rainwater that runs off from rooftops, parks, roads, open grounds, etc. for later use. Here, let us have a look at the diagram of rainwater harvesting system. Rainwater harvesting systems consists of the following components:

- Catchment- Used to collect and store the captured rainwater.
- Conveyance system – It is used to transport the harvested water from the catchment to the recharge zone.
- Flush- It is used to flush out the first spell of rain.
- Filter – Used for filtering the collected rainwater and removing pollutants.
- Tanks and the recharge structures: Used to store the filtered water which is ready to use.

The process of rainwater harvesting involves the collection and the storage of rainwater with the help of artificially designed systems that run off naturally or man-made catchment areas like- the rooftop, compounds, rock surface, hill slopes, artificially repaired impervious or semi-pervious land surface.

Several factors play a vital role in the amount of water harvested. Some of these factors are:

- The quantum of runoff
- Features of the catchments
- Impact on the environment
- Availability of the technology
- The capacity of the storage tanks
- Types of the roof, its slope and its materials
- The frequency, quantity and the quality of the rainfall
- The speed and ease with which the rainwater penetrates through the subsoil to recharge the groundwater.

KEYWORDS: rainwater, harvesting, traditional, methods, Rajasthan

I. INTRODUCTION

Water has been harvested in India since antiquity, with our ancestors perfecting the art of water management. Many water harvesting structures and water conveyance systems specific to the eco-regions and culture has been developed.

- They harvested the rain drop directly. From rooftops, they collected water and stored it in tanks built in their courtyards. From open community lands, they collected the rain and stored it in artificial wells.

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- They harvested monsoon runoff by capturing water from swollen streams during the monsoon season and stored it various forms of water bodies.
- They harvested water from flooded rivers[1,2]

Paar system:

Paar is a common water harvesting practice in the western Rajasthan region. It is a common place where the rainwater flows from the agar (catchment) and in the process percolates into the sandy soil. In order to access the rajani pani (percolated water) kuis or beris are dug in the agor (storage area). Kuis or beris are normally 5 metres (m) to 12 m deep. The structure was constructed through traditional masonary technology. Normally six to ten of them are constructed in a paar. However depending on the size of the paar the numbers of kuis or beris are decided. Bhatti mentions that there are paars in Jaisalmer district where there are more than 20 kuis are in operation. This is the most predominant form of rainwater harvesting in the region. Rainwater harvested through PAAR technique is known as Patali paani.

Talab / Bandhis:

Talabs are reservoirs. They may be natural, such as the ponds (pokhariyan) at Tikamgarh in the Bundelkhand region. They can be human-made, such the lakes in Udaipur. A reservoir area of less than five bighas is called a talai; a medium sized lake is called a bandhi or talab; bigger lakes are called sagar or samand. The pokhariyan serve irrigation and drinking purposes. When the water in these reserviors dries up just a few days after the monsoon, the pond beds are cultivated with rice.

Saza Kuva:

An open well with multiple owners (saza = partner), saza kuva is the most important source of irrigation in the Aravalli hills in Mewar, eastern Rajasthan. The soil dug out to make the well pit is used to construct a huge circular foundation or an elevated platform sloping away from the well. The first is built to accomodate the rehat, a traditional water lifting device; the sloping platform is for the chada, in which buffaloes are used to lift water. Saza kuva construction is generally taken up by a group of farmers with adjacent landholdings; a harva, a man with special skills in groundwater detection, helps fix the site.

Johad:

Johads are small earthen check dams that capture and conserve rainwater, improving percolation and groundwater recharge. Starting 1984, the last sixteen years have seen the revival of some 3000 johads spread across more than 650 villages in Alwar district, Rajasthan. This has resulted in a general rise of the groundwater level by almost 6 metres and a 33 percent increase in the forest cover in the area. Five rivers that used to go dry immediately following the monsoon have now become perennial, such as the River Arvari, has come

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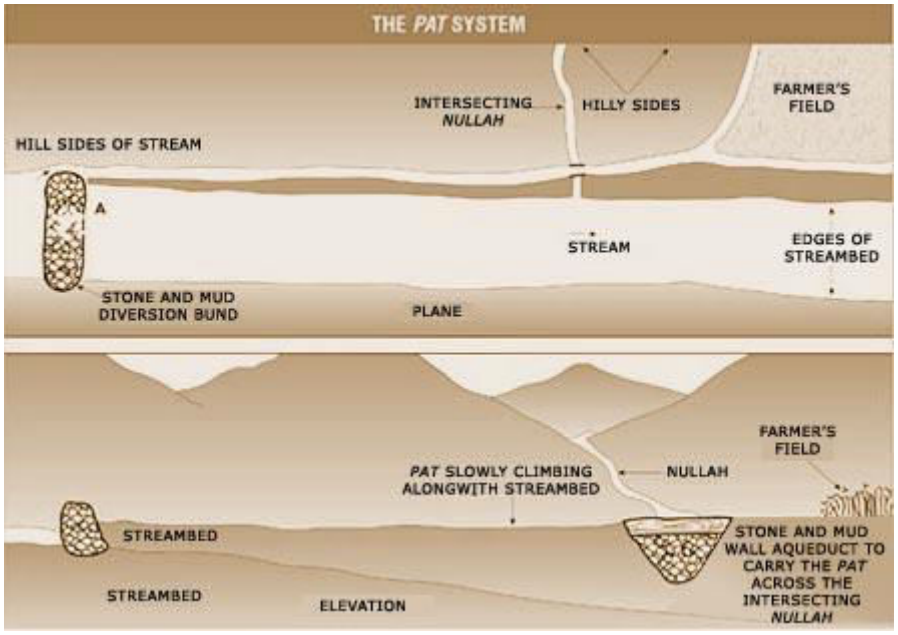
alive.[3,5]

Pat:
Bhitada village , Jhabua district of Madhya pradesh developed the unique pat system. This system was devised according to the peculiarities of the terrain to divert water from swift-flowing hill streams into irrigation channels called pats.



The diversion bunds across the stream are made by piling up stones and then lining them with teak leaves and mud to make them leakproof. The pat channel has to negotiate small nullahs that join the stream off and on, and also sheer cliffs before reaching the fields. These sections invariably get washed away during the monsoons. Stone aqueducts have to be built to span the intervening nullahs.[7,8]

The villagers irrigate their fields by turns. The channel requires constant maintenance and it is the duty of the family irrigating the fields on a particular day to take care of the pat on that particular day. It takes about two weeks to get the pat flowing and the winter crop is sown in early November.

II. DISCUSSION

A taanka or paar, is a traditional rainwater harvesting technique, common to the Thar desert region of Rajasthan, India.[1] It is meant to provide drinking water and water security for a family or a small group of families. A taanka is composed of a covered, underground, impermeable cistern on shallow ground for the collection of rainwater. The cistern is generally constructed out of stone or brick masonry, or concrete, with lime mortar or cement plaster. Rainwater or surface run-off from rooftops, courtyards, or artificially prepared catchments (locally called agor) flow into the tank through filtered inlets in the wall of the pit.[2][3]

The water stored saves people from the daily task of walking long distances to fetch water from sources which are often contaminated. The water in a taanka is usually only used for drinking. If in any year there was less than normal rainfall and household tanka do not get filled, water would instead be obtained from nearby wells and tanks to fill the tanks.

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History

Taankas were usually constructed near religious centers and in villages for community usage due to the belief in the sanctity of water. This preservation technique is an ancient practice dating back to at least 1607 A.D. near Jodhpur.[4][5]

However, people now generally prefer to construct taankas locally in each hamlet and are owned and maintained by individual families. This shift is mainly due to dominant groups monopolizing or taking disproportionate shares of communal water, marginalizing the needs of poor and lower caste. Generally, community structures now fail through underinvestment leading to poor workmanship and aftercare.

The technique was largely abandoned in the later 20th century as pipes lines or hand pumps were laid to transport water from Perennial Rajasthan Canal to their houses, though some houses still maintain the taankas since they do not like the taste of tap water. When the region was faced with drought-like situations, inadequate supplies of piped water on the account of growing population, and depleted or contaminated ground water, this traditional method was revived, along with other traditional rainwater harvesting structures like, Naadi, a village pond and Beri, a small rainwater-collecting wells, especially for supplying drinking water.[9,10]

Though originally found in the desert towns, the system has since gained immense popularity in rural areas. In Phalodi, Barmer and Balotra region, rural taankas were found that were 6.1 meters (20 ft) deep, 4.27 meters (14 ft) long and 2.44 meters (8 ft) wide. This technique of harvesting rainwater was perfected to a fine art in the arid regions of western Rajasthan. Such water harvesting structures have also been reported being built in other arid developing countries such as Botswana, Ghana, Kenya, Yemen, Sri Lanka, Thailand, and Indonesia.[6]

Bikaner was founded by Rao Bika in 1488 AD. The choice of Bikaner as an urban center seems to have been strongly influence by the availability of tracts of mudiya kanker, also known as murrum (मूरड़), a particular set of gravel and dirt which compacts easily when mike with water and possesses excellent run off characteristics. This facilitated rainwater harvesting through an elaborate network of taankas.[7]

Construction

Traditional family-managed taankas are constructed by digging a hole of 3 to 4.25 meter diameter in the ground and plastering it with lime mortar cement about 6 mm thick, followed by a cement plaster of about 3 mm thickness. Most modern taankas have a capacity of around 21,000 liters but larger ones can be constructed where resources are available.[6]

Commonly, the catchment area, known as an agor, is a concave cemented funnel-like slope directing water into a collection pit that reduces the sediment load of water before it enters the underground cistern via a suitable mesh supported by bars in an angle iron frame to filter out other large debris. The micro-catchment avoids seepage and prevents erosion, and is fenced to restrict animal entry. The bottom of the cistern is also concave facilitating extraction of the maximum amount of water from the taanka. The cistern has a top cover to prevent evaporation and pollution of stored water by foreign matter. A galvanised iron cover is built into the cover to facilitate withdrawal of water. Taanka covers are ventilated, helping to prevent bad odor in the stored water. Outlets are provided to allow excess water falling during the monsoon to escape.[11,12]

Taankas are often beautifully decorated with tiles, which also keep the water cool.[7]

Usage and Maintenance

Taanka require cleaning at least once a year, typically before the onset of the monsoon. This includes desilting the taanka cistern, sweeping the micro-catchment, and painting inlets and the outlet to keep the system in good working condition. Periodic dosing with oxidizing agents, such as potassium permanganate, helps prevent the growth of microscopic organisms and the consequent development of bad taste, odor and color in the water. Alum additions also help to settle suspended matter. At least a few centimetres of water should always be maintained in the taanka

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to ensure that the cistern walls remain moist, avoiding the development of cracks and other physical defects. If well maintained, a taanka has a service life of at least for 30 years.[8]

Usage in Present Day

In towns around Bikaner, there was an abundance of tanks. The most important ones being at Kolayat with a catchment area of 14,900 ha (37,000 acres), Gajner 12,950 ha (32,000 acres), and Ganga sarovar with 7,950 hectares (19,600 acres). The water needs of the town were met by the innumerable tanks in and around Bikaner, together with the wells and taankas that each house traditionally built for harvesting rainwater from the roof tops. The water from the taankas was used only for drinking purposes. If in any year there was less than normal rainfall and the taankas did not get filled, water from proximal wells and tanks would be obtained to fill the household taankas. In this way, the people of Bikaner were able to meet their water requirements.

III. RESULTS

Stepwells (also known as vavs or baori) are wells or ponds with a long corridor of steps that descend to the water level. Stepwells played a significant role in defining subterranean architecture in western India from 7th to 19th century.[1] Some stepwells are multi-storeyed and can be accessed by a Persian wheel which is pulled by a bull to bring water to the first or second floor. They are most common in western India and are also found in the other more arid regions of the Indian subcontinent, extending into Pakistan. The construction of stepwells is mainly utilitarian, though they may include embellishments of architectural significance, and be temple tanks.

Stepwells are examples of the many types of storage and irrigation tanks that were developed in India, mainly to cope with seasonal fluctuations in water availability. A basic difference between stepwells on the one hand, and tanks and wells on the other, is that stepwells make it easier for people to reach the groundwater and to maintain and manage the well.[13]

The builders dug deep trenches into the earth for dependable, year-round groundwater. They lined the walls of these trenches with blocks of stone, without mortar, and created stairs leading down to the water.[2] This led to the building of some significant ornamental and architectural features, often associated with dwellings and in urban areas. It also ensured their survival as monuments.

A stepwell structure consists of two sections: a vertical shaft from which water is drawn and the surrounding inclined subterranean passageways and the chambers and steps which provide access to the well. The galleries and chambers surrounding these wells were often carved profusely with elaborate detail and became cool, quiet retreats during the hot summers.[3]

Names

A number of distinct names, sometimes local, exist for stepwells. In Hindi-speaking regions, they include names based on baudi (including bawdi (Rajasthani: बावड़ी), bawri, bawari, baori, baoli, bavadi and bavdi). In Gujarati and Marwari language, they are usually called vav, vavri or vaav (Gujarati: વાવ). Other names include kalyani or pushkarani (Kannada), baoli (Hindi: बावली) , barav (Marathi: बारव) and degeenar

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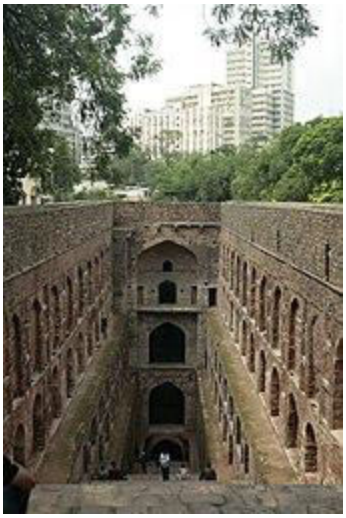
History



Agrasen Ki Baoli in New Delhi, rebuilt in the 14th century

The stepwell may have originated during periods of drought to ensure enough access to the water. The earliest archaeological evidence of stepwells is found at Dholavira where the site also has water tanks or reservoirs with flights of steps. Mohenjo Daro's great bath is also provided with steps on opposite directions. Ashokan inscriptions mention construction of step wells along major Indian roads at a distance of every 8 kos for the convenience of travellers, but Ashoka states that it was a well established practice which predated him and was done by former kings as well.

King Devanampriya Priyadarsin speaks thus. On the roads banyan-trees were caused to be planted by me, (in order that) they might afford shade to cattle and men, (and) mango-groves were caused to be planted. And (at intervals) of eight kos wells were caused to be dug by me, and flights of steps (for descending into the water) were caused to be built. Numerous drinking-places were caused to be established by me, here and there, for the enjoyment of cattle and men. [But] this so-called enjoyment (is) [of little consequence]. For with various comforts have the people been blessed both by former kings and by myself. But by me this has been done for the following purpose: that they might conform to that practice of morality.

—Ashokan Pillar Edict No 7

The first rock-cut stepwells in India date from 200–400 AD.[4] The earliest example of a bath-like pond reached by steps is found at Uperkot caves in Junagadh. These caves are dated to the 4th century. Navghan Kuvo, a well with the circular staircase in the vicinity, is another example. It was possibly built in Western Satrap (200–400 AD) or Maitraka (600–700 AD) period, though some place it as late as the 11th century. The nearby Adi Kadi Vav was constructed either in the second half of the 10th century or the 15th century.[5]

The stepwells at Dhank in Rajkot district are dated to 550–625 AD. The stepped ponds at Bhinmal (850–950 AD) are followed by it.[4] The stepwells were constructed in the southwestern region of Gujarat around 600 AD; from there they spread north to Rajasthan and subsequently to the north and west India. Initially used as an art form by Hindus, the construction of these stepwells hit its peak during Muslim rule from the 11th to 16th century.[3]

One of the earliest existing examples of stepwells was built in the 11th century in Gujarat, the Mata Bhavani's Stepwell. A long flight of steps leads to the water below a sequence of multi-story open pavilions positioned along the east/west axis. The elaborate ornamentation of the columns, brackets and beams are a prime example of how stepwells were used as a form of art.[6]

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The Mughal emperors did not disrupt the culture that was practiced in these stepwells and encouraged the building of stepwells. The authorities during the British Raj found the hygiene of the stepwells less than desirable and installed pipe and pump systems to replace their purpose.[6]

Location of a stepwell[12]

A stepwell is generally located in three types of places - as an extension or part of a temple, in or at an edge of a village, and/or the outskirts of a village.[2] When a stepwell is associated with a temple or a shrine, it is either at the opposite wall of it or in front of the temple. Sindhvai Mata stepwell in Patan, Mata Bhavani stepwell in Ahmedabad, and the Ankol Mata stepwell in Davad serve as a great example of the stepwells that house shrines.[2]

Function and use

The stepwell ensures the availability of water during periods of drought. The stepwells had social, cultural and religious significance.[6] These stepwells were proven to be well-built sturdy structures, after withstanding earthquakes.[2] Most places in India where there is abundant fresh water only during the monsoon season, stepwell and wells play a critical role in serving as a direct means to fresh water filtered through the earth. While the rivers, rivulets, creeks, and other natural water bodies dry up in this climate zone, stepwell and wells remain at a depth where there is less exposure to sun and heat.[2] The majority of surviving stepwells originally served a leisure purpose alongside being main source of water for basic needs like bathing, washing clothes, farming, and watering animals. Stepwells also served as a place for social gatherings and religious ceremonies. Usually, women were more associated with these wells because they were the ones who collected the water. Also, it was they who prayed and offered gifts to the goddess of the well for her blessings.[2]

The well-water is known to attract insects, animals, and many other germ breeding organisms. These stepwells, being a common space in frequent use by the inhabitants of the area, were considered to be a source of spreading epidemics and diseases.[2]

Details[edit]

Many stepwells have ornamentation and details as elaborate as those of Hindu temples. Proportions in relationship to the human body were used in their design, as they were in many other structures in Indian architecture.[7]

Stepped ponds

Stepped ponds are very similar to stepwells in terms of purpose. Generally, stepped ponds accompany nearby temples while stepwells are more isolated.[8] Stepwells are dark and barely visible from the surface, while stepped ponds are illuminated by the light from the sun. Stepwells are quite linear in design compared to the rectangular shape of stepped ponds.[7]

In India

A number of surviving stepwells can be found across India, including in Rajasthan, Gujarat, Delhi, Madhya Pradesh, Maharashtra, and North Karnataka (Karnataka). In 2016 a collaborative mapping project, Stepwell Atlas,[9] started to map GPS coordinates and collate information on stepwells, mapping over 2800 stepwells in India. Another project mapped the location of over 1700 stepwells in Maharashtra.[10]

In his book Delhi Heritage: Top 10 Baolis, Vikramjit Singh Rooprai mentions that Delhi alone has 32 stepwells.[11] Out of these, 16 are lost, but their locations can be traced. Of the remaining 16, only 14 are accessible to public and the water level in these keeps varying, while two are now permanently dry.[10]

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IV. CONCLUSION

Thar desert on India's northwest periphery is full of challenges. Extending westwards from the Aravalli mountains, it is a vast expanse of sand, rocky outcrops, and scorching earth. Daytime temperatures can reach 50 degrees Celsius, while rainfall is erratic and can be as little as 50 millimeters during an entire year. Yet, Thar is home to the highest human (and perhaps even cattle) density among any large desert worldwide. It is also known for a wide variety of fauna in the wild, including the blue bull, blackbuck, Indian gazelle or chinkara, desert fox, and the great Indian bustard, among many others.

It is a fragile ecosystem where humans survived for centuries by building ingenious structures to preserve the most valuable commodity in this arid climate – water. Water was the currency in which the local economy operated. However, what took ages to develop is in rapid decline.

Many water management systems are in disrepair due to encroachment in their catchment areas or a lack of knowledge on how to run them. Reviving these traditional systems requires an understanding of their crucial role. Two such systems are the nadis and khadeens. While nadis can be seen in many parts of western Rajasthan, khadeens are more common in Jaisalmer.

Jaisalmer is the westernmost district in India, and area-wise, it is the largest in the province of Rajasthan. Almost all of its area lies in the arid belt of the Thar desert. Everywhere, there are large expanses of sand. Jaisalmer was a trading post on the bustling silk route, serving as its southern artery. The 800-year-old local fort reminded travelers and traders on the silk route that there was a functioning kingdom with a firm grip on the local economy. India's independence and partitioning of the Thar afterward turned this area from the epicenter of a vast desert to the westernmost front of a newly born nation.[11]

Water conservation in the Thar

The question we must confront is: with the monsoon becoming so miserly by the time it arrives in the desert and with the absence of any perennial rivers in the area (even the seasonal Luni grazes the southeastern tip of the district), how did people survive here? How did the locals deal with this extreme scarcity of water? The answer lies in the mindset of the people who considered water to be plenty once they discovered how to conserve it. Wherever rain fell, it was carefully diverted and used wisely; and when there was no rain, there was water to be harvested from the sub-surface recharge aquifers. So confident were the local masons in their skill that despite recurrent droughts, there were few famines.

While many of these traditional water harvesting structures now lie dilapidated, some are still functional even after centuries of use. An outsider can easily miss these, especially in the dry season when the gentle contours that lead to water diversion are hard to differentiate from what appears to be a flat landscape. Some structures store water to quench human and animal thirst, while others let the water percolate below the surface to allow a second crop during winter.

Nadis: the shallow ponds

Nadis are shallow, artificial ponds that can store water for a few months to year-round. They are usually located in village grasslands known as orans and gauchars, making them part of mixed water-pasture regimes. For them to function well, these regimes need careful maintenance lest the water-holding impermeable layer of soil is breached. Local rulers commissioned such nadis to retain water for human and animal consumption. They marked these nadis with stone pillars that carried information on when and how these nadis were constructed. Nadis are essential for maintaining the desert's economy. Even after the construction of the Indira Gandhi Canal, far-flung

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villages rarely receive any water from the canal. These villages must depend on their old reservoirs to ensure water supply during the long dry months.

An example of such a nadi can be seen in Mokla village, 29 kilometers northwest of Jaisalmer on the Jaisalmer-Ramgarh highway. On approach to the village, one is presented with a sight to behold – a scrubby landscape interspersed with khejri (Prosopis cineraria) and ber (Ziziphus) trees. Much of this landscape in Mokla is part of Dungar Pir ji Oran, a sacred grassland extending to over 40,000 bighas (about 6,500 hectares). Indeed, it is common to see herds of camels lazily browsing on khejri trees in the area. The oran has been with the village for centuries, and the local community is currently registering it with the district administration. Most orans in Rajasthan are associated with a local deity, hence being revered as sacred. The Dungar Pir ji temple, located within Mokla's oran, is a small but imposing structure covered in white, with beautiful frescoes painted on its outer walls. Next to the temple is a shallow pond or nadi, that stores water flowing in from a catchment that extends to several hundred hectares of the oran. It is the Jelipa nadi, and legend has it that it has existed for more than 800 years, as old as the Jaisalmer fort itself. Trees in the orans slow the water runoff, hence more percolation of rainwater into the nadi. Nadis are a lifeline for cattle and even wildlife in remote areas with few water sources during the dry season.

Khadeens: the muddy dams

A few kilometers from the Dungar Pir Ji oran is another ingenious water harvesting structure called khadeen (or khadin). At first, one only sees flat lands with some moisture visible on the surface. Away, in the distance, is a low, muddy dam (less than a meter in height) that extends to hundreds of meters. The dam and the upstream area around it constitute a khadeen, a centuries-old invention of the Paliwal brahmins of this area. Khadeens are constructed on gently sloping lands with fertile topsoil, even if a non-porous, rocky layer is underneath. During monsoon rains, the low khadeen wall is a barrier to the flowing water. So, fields immediately behind the wall remain submerged during rains while those at a higher level upstream retain enough moisture for a good monsoon crop. Come November, and if surface water is still in the catchment, sluice gates are opened in the dam to drain out excess water downstream. The area is now ready for a second winter crop, supported by the residual moisture in the soil. The result is a doubling (and sometimes even tripling) of the number of food crops farmers can take in the area. Earlier, khadeens were constructed only with earthen embankments, but nowadays, khadeens are constructed with cemented walls too.[12]

Khadeens irrigate thousands of hectares in the desert. But individual households only own small plots, so a khadeen is like a commune with an entire community able to support their agriculture-based livelihood. However, with the arrival of irrigation through borewells, and canal water, many of these khadeens are in disrepair.

While both khadeens are nadis are shallow structures that store water, how does one differentiate between the two? Khadeens are located on farmlands with occasional trees, nadis usually do not have any trees. Nadis can also carry water year-round, while khadeens are emptied at the start of winter to allow a second crop from residual moisture. Both these structures can add to the area's resilience against dry climate when functioning well. But like endangered wildlife in the area, these ingenious structures constitute the vanishing equity of the Thar desert.[13]

REFERENCES

1) Rainwater harvesting in rural India - taankas in the Thar Desert, by Megan Konar, Waterlines, Volume 25, Number 4, April 2007, pp. 22-24(3). Publisher: Practical Action Publishing.
2) ^ Rainwater Harvesting Structures: 1: Taanka Indian Villages 2020 (in 2 Volumes)vision And Mission (vol. 1)strategies And Suggested Development Models (vol 2), Y.P. Singh (ed.). Concept Publishing Company, 2006. ISBN 818069321X. Page 421 .

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| DOI:10.15680/IJMRSET.2022.0506096 |

3) ^ Community initiatives in capturing rain through terrain-specific technologies: examples from India IWA International Water Association website
4) ^ Water Harvesting & Management. Vol. Improving Land Management in Rajasthan, Swiss Agency for Development and Cooperation, 2003.
5) ^ Mishra, Anupam. "Water Use: Traditional Systems and Practices." Water Harvesting and Management, Swiss Agency for Development and Cooperation, 2003
6) ^ [a b] Mahnot, S. C., and P. K. Singh. "Arid Zone Water Harvesting." Water Harvesting and Management, Swiss Agency for Development and Cooperation, 2003.
7) ^ [a b] Water Harvesting Systems : Traditional Systems. http://www.rainwaterharvesting.org/Rural/Traditional2.htm#tank. Accessed 30 Dec. 2019.
8) ^ Vangani, N. S., et al. Tanka—A Reliable System of Rainwater Harvesting in the Indian Desert. Central Arid Zone Research Institute, 1988, http://www.cazri.res.in/publications/KrishiKosh/60-(TANKA-A%20RELIABLE%20SYSTEM%20OF%20RAINWATER%20).pdf
9) Traditional Water Resource Management Through Innovative Techniques, Rajendra Kumar, Jodhpur 2009
10) Anupam Mishra (1995), "Rajasthan ki rajat bunde", Published by Gandhi Shanti Prathisthan, New Delhi.
11) Pravesh Kumar (2007), "Importance of water harvesting in Rajasthan", Water Wheel, August 2007, P 5-7.
12) D.C. Ojha (1997), "Thar Desert: An Overview of Desertification", ENVIS Centre on Desertification, Central Arid Zone Research Institute.
13) Bharat Jhunjhunwala (2005), Traditional Agricultural and water technologies of the Thar, Kalpaz Publications
14) Madhukar Gupta (2002), "Drought Management in Rajasthan", Report of District Collector & Magistrate, Nagaur, Rajasthan, India.

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