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Traditional Water Conservation Techniques in Luni Basin

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ABSTRACT: Water is a critical factor for development planning in Luni Basin. Despite heavy investments in water resources, the people of Rajasthan are suffering from water scarcity. Water resource management is largely exploitative rather than conservationist. Tradition methods of water conservation have been neglected. Annual rainfall in Rajasthan is highly variable and scanty. The important task before us is to harvests this seasonal and natural precipitation. The north western desert tract gradually improves from an arid desert in the far west to a comparatively habitable and fertile tract towards and the northwest. Cultivation in the desert region is poor and precarious, though some tracts have better soils and are more productivity. The key activities to conserve water are as follows: any beneficial reduction in water loss, use and waste of resources,[3] avoiding any damage to water quality; and improving water management practices that reduce the use or enhance the beneficial use of water.[4][5] Technology solutions exist for households, commercial and agricultural applications. Water conservation programs involved in social solutions are typically initiated at the local level, by either municipal water utilities or regional governments.

KEYWORDS: traditional, Luni basin, resource, management, cultivation, conservation, water, techniques, rainfall

I.INTRODUCTION

The arid parts of Rajasthan are a near rainless desert. In some areas, rainfall scarcely averages more than 120 mm. irrigation is limited by the scarcity of water in the west of the desert and has traditionally been restricted to deep wells and rain water harvesting systems. By and large, land use is dependent on rainfall[1]. In good rainfall years, large areas cropped, cattle thrive on extensive pastures and substantial amounts of hay are stored for future use. Rain water is stored in ponds and underground tanks. Small earthen embankments were constructed by the number of cultivators to enclose as much land as they could and surround it with thorns to keep animals away. Most villages in the desert tract had small ponds, and in a good season there was sufficient water to drink for seven to eight months.[2] If rainfall failed, water was available for only four to six months otherwise the villagers had to bring water from other villages 20-30 km away. In some of the villages had tankas or circular holes in the ground, lined with fine polished chuna (lime) in water was collected during rainfall and used when other supplies failed. In Luni Basin, there are various traditional water resources systems –nadi, talab, jojad, bandha, sagar, samand and sarovar, just to name a few. Traditional methods of harnessing surface water may provide some alternatives to meet the problem of water demand.[3] A systematic study of similar traditional water harnessing methods is needed to make policy-makers aware of these alternative sources.

The Aims of water conservation efforts include:

- With less than 1% of the worlds water being freshwater,[6] one aim is ensuring the availability of water for future generations where the withdrawal of freshwater from an ecosystem does not exceed its natural replacement rate.[4]
- Energy conservation as water pumping, delivery, and wastewater treatment facilities consume a significant amount of energy. In some regions of the world, over 15% of the total electricity consumption is devoted to water management.
- Habitat conservation where minimizing human water usage helps to preserve freshwater habitats for local wildlife and migrating waterfowl, but also water quality.[7]

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One of the strategies in water conservation is rain water harvesting.[8] Digging ponds, lakes, canals, expanding the water reservoir, and installing rain water catching ducts and filtration systems on homes are different methods of harvesting rain water. Many people in many countries keep clean containers so they can boil it and drink it, which is useful to supply water to the needy.[8] Harvested and filtered rain water can be used for toilets, home gardening, lawn irrigation, and small scale agriculture.[8]

Water conservation by rain water harvesting in Luni Basin areas living inhabitants :-

Jhalaras are square stepwells and have steps on four sides collect subterranean percolating water of lake. Jhalaras have regular supply of water . Water can be used for household works, religious purposes, ceremonies and all purpose use. Jhalaras are there in many parts of Rajasthan especially in Luni Basin areas many Jhalaras are there. Mahamandir jhal is oldest one.[5]

Talabs are stockpile to store water.They can be used for drinking and household works. Pokhariyan is natural talab and many talabs near Luni basin are man made as lakes .The receptacle in less than 5 bighas is Talai, medium sized is Bandhi and biggest is Sagar or Samand.[6]

Tanka is traditional water storage system. It is not natural water storage system it is made artificially. Tank is water storage system. It is oval (Cylindrical) underground well in which Rainwater is stored. Once made Tanka stores water for 6-7 persons for summers. The members of families have not to go far to fetch water .[7]

Ahar Pynes are made to store overflowing flood water. These are made to store water with barriers on 3 sides. Rice fields are deluge with Ahar pynes during dry months (Summers). Pynes are artificial channels from river .[8]

Johads are small fictile dams to store rain water. Johads are connected with water channels these are very old rain water harvesting systems. Called Madak also, johad in Rajasthan, and Pemghara in Luni Basin.[9]

Panam keni are water harvesting system in Wayanad Kuruma tribe store water in this way. Cylindrical , 4-5 feet in diameter and 4-5 feet in depth in groundwater. Wooden cylinders are made by toddy palm stem. These wells have water in May june months also.

Khadin dhana (Dhora) Paliwal Brahmins use these Khadin water harvesting systems. These water harvesting systems are also used in Jaisalmer alongwith Luni Basin. Long earth bank on slope Land is gravel. These are excellent traditionl water harvesting system. [10]

Kund -These are found in Gujarat alongwith nearby areas of Luni basin. Raja Sur Singh (1607 AD)made first Kund in Vadi ka Melan village.This is bowl shaped area and underground well is there in center. Covered with lime and ash (disinfectant).

Bawari- These are stepwells which were used to store water in ancient water scarce Rajasthan cities. These will also increase groundwater . Steps minimize loss of water.The region receive very low rain. Man made tanks are also connected .[11]

Baoli Made for philanthropic reasons. These are build in Rajasthan, nearby Luni basin. These are Stepwells , used during social gatherings. Were also found on trade routs. Water can also be used for drinking and household works.

Nadi Found in Jodhpur (Rajasthan),and many cities of Rajasthan and nearby Luni basin used to conserve rainwater . Mewar Krishi Vikas Samiti are cleaning these Nadis to avoid siltation. These have large water storage capacity. Found near Jodhpur in Rajasthan, and around areas of Luni basin , nadis are village ponds that store rainwater collected from adjoining natural catchment areas. The location of a nadi has a strong bearing on its storage capacity and hence the site of a nadi is chosen after careful deliberation of its catchment and runoff characteristics. Since nadis received their water supply from erratic, torrential rainfall, large amounts of sandy sediments were regularly deposited in them, resulting in quick siltation. A local voluntary organisation, the Mewar Krishak Vikas Samiti (MKVS) has been adding systems like spillways and silt traps to old nadis and promoting afforestation of their drainage basin to prevent siltation.[12]

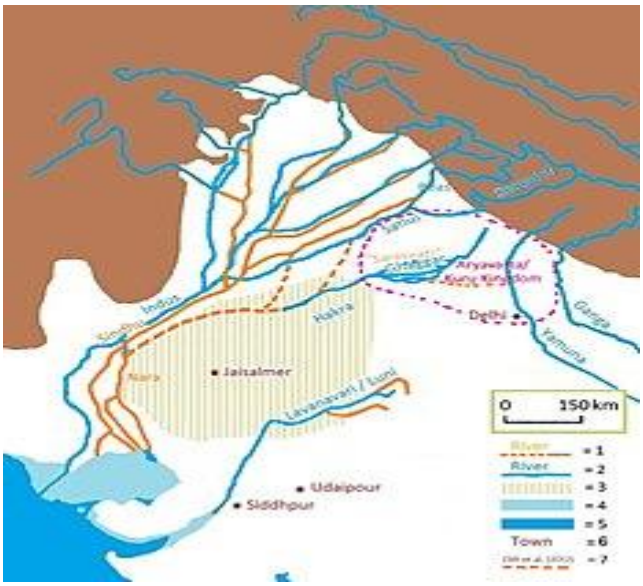
Phad, a community-managed irrigation system, probably came into existence a few centuries ago. The system starts with a bhandhara (check dam) built across Luni river, from which kalvas (canals) branch out to carry water into the fields in the phad (agricultural block). Sandams (escapes outlets) ensure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

Luni Basin areas harvest water through Kuhls also. These collects water which come from mountains of Aravalli. This water is carried to fields. [13]

Rainwater which falls on Aravalli hills is collected in puddles . And later it is used for forests , Farms, and agriculture. Tranquilled water is also used for cattles, fishes, for medicinal plants, Birds. Zabo or Ruza collect runoff water for use in fields, Plants, Animals, Cattles, Birds, Fishes and for human use.

II.DISCUSSION

The Luni is the largest river in the Thar Desert of northwest India.[1] It originates in the Pushkar valley of the Aravalli Range, near Ajmer, passes through the southeastern portion of the Thar Desert, and ends in the marshy lands of Rann of Kutch in Gujarat, after travelling a distance of 495 km (308 mi). It is first known as Sagarmati, then after passing Govindgarh, it meets its tributary Sarasvati, which originates from Pushkar Lake and from then on it is called Luni.[14]



Course of River Luni or Lavanaravi river, south of the estimated route of the ancient Sarasvati river

In 1892, Maharaja Jaswant Singh II of Jodhpur constructed Jaswant Sagar in Pichiyak village between Bilara and Bhawi of Jodhpur district. It is one of the largest artificial lakes in India and irrigates more than 12,000 acres (49 km^2).[2] It is one of the internal drainage rivers in India; it does not meet with Arabian Sea. It is drained before it reaches the Arabian Sea.[15]

The Luni is also known as the Lavanavari or Lavanavati, which means "salt river" in Sanskrit, due to the high salinity of its water.[2] The Luni River basin is 37,363 km^2, which includes all or part of the Ajmer, Barmer, Jalore, Jodhpur, Nagaur, Pali and Sirohi districts of Rajasthan and the Banaskantha and Patan districts of northern Gujarat. Its major tributaries are the Sukri, Mithri, Bandi, Khari, Jawai, Guhiya and Sagi from the left and the Jojari from the right.[1]

The Luni River begins near Ajmer in the Pushkar valley of the western Aravalli Range at an elevation of about 550m. At this point, the river is also known as the Sagarmati. The river then flows in the southwest direction through the hills and plains of the Marwar region in Rajasthan. The river flows south-west and enters the Thar Desert before dissipating into the Rann of Kutch, traversing a total of 495 km. In spite of the high salinity, it is a major river in the region and serves as a primary source of irrigation. The Luni is not saline until it reaches Balotra, where high salt content in the soil impacts the river.[16]

The Luni may have been the southern portion of the historic Ghaggar-Hakra river channel.[1]

The Jawai, Sukri, Guhiya, Bandi and Jojari rivers are the main tributaries of Luni river. The Jojari is the only tributary that merges to the right-bank of the river while other 10 tributaries reach its left bank. All the tributaries except Jojari originates from the Aravalli hill.[3][4][5] The dams in Luni river are:[3]

- Sipu dam

- Jaswant Sagar Dam - built in 1892 by Maharaja Jaswant Singh.It is one of the largest artificial lakes in India.[17]

The two major irrigation projects on Luni river are SardarSamand and Jawai dam.[3] Sardar Samand dam was constructed in 1905.

Flash floods have occurred in the Luni river as the river flows on a shallow bed and the riverbank soil is easily flattened by the rain water.[3]

The worst flood happened in 2006, when the desert region received heavy rain. The water levels rose to 15–25 feet submerging the surrounding region. The 2006 flash floods caused water levels to rise to as high as 15–25 feet submerging many parts along the river in the Barmer district. A large number of people and animals died in the flood.[3]

In 2010, another flood occurred but there were less casualties.[3]

The fish diversity assessment of Luni river reported the occurrence of 27 species belonging to 22 genera, dominated by Cyprinids. The highest fish diversity of 12 species was reported in Samdhari and Gandhav. In this study, the wide distribution of Invasive Fish Species such as African Catfish[18] (*Clarias gariepinus*) and *Mozambique tilapia* (*Oreochromis mossambicus*) were also reported from the river Luni.[6]

Luni River is the only saline river in India. The word "Luni" is taken from the Sanskrit word "lavanavari," which signifies salt water. The high salinity of the river is the reason behind its name. For the initial hundred kilometres, the freshwater in Luni is fresh, but as it gets closer to Balotra in Barmer, it starts to get salty from the high amount of salt of the land it flows on.[19]

The Luni River rises 772 metres above sea level in Rajasthan's Ajmer district from the Naga hills of the Aravalli Range. The river Luni, locally known as Sagarmati, flows through the Rajasthani districts of Nagaur, Pali, Jodhpur, Barmer, and Jalore as it travels 495 kilometres in a south-western direction towards Gujarat. The river gradually runs out in Gujarat's Barine, close to the Rann of Kutch. The astounding feature is that the river's stream sinks across a shallow bank before coming to an end and not entering any other bodies of water.[20]

The river Luni, while being saline, is a major irrigation supplier for Rajasthan's parched regions, and as a result, the residents consider it to be sacred. Maharaja Jaswant Singh of Jodhpur constructed the Jaswant Sagar Dam close to Pichiyak hamlet in the Jodhpur area in 1892 to harness the water from Luni.[21]

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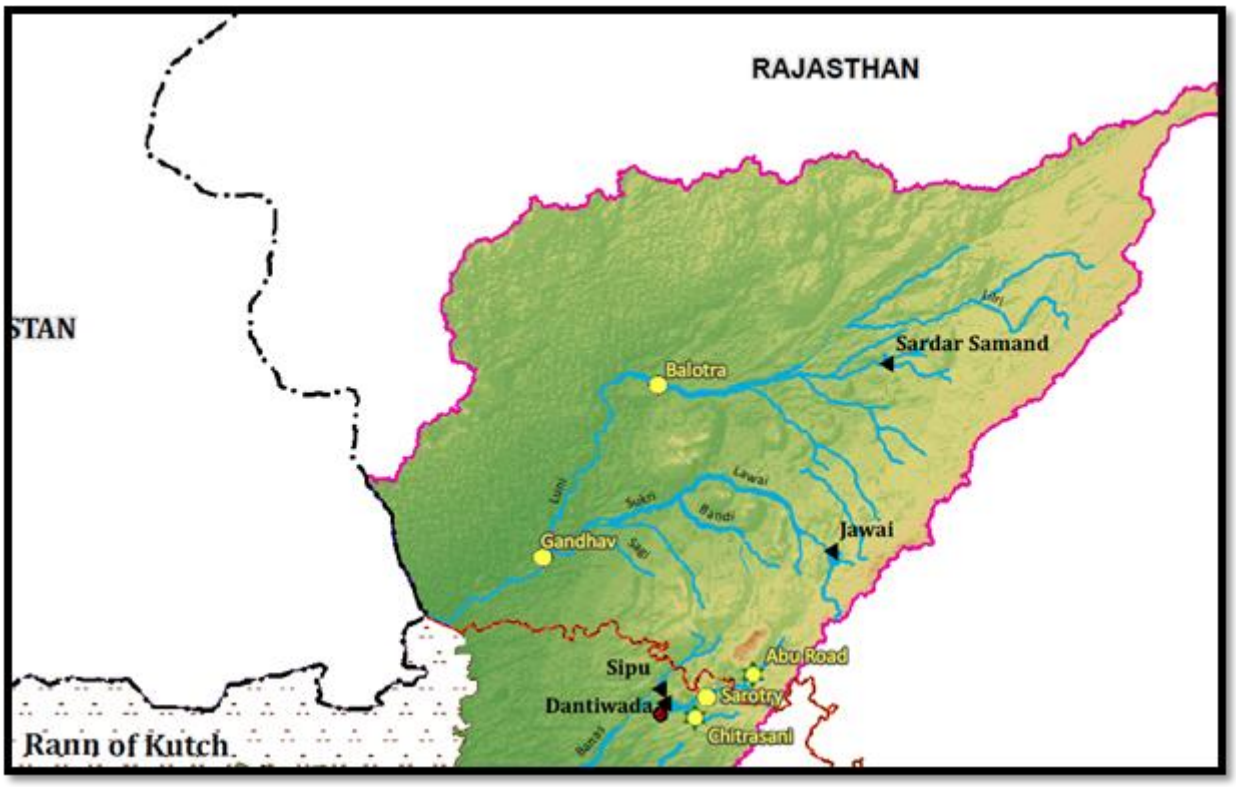

The Luni basin is bordered to the east by the Aravalli range and Gujarat plains, on the north by the Rajasthan sand, and on the south and west by the Arabian Sea. The Luni basin has a total area of 32,879 square kilometres and contains a number of locations in the Ajmer region, from Nagaur to Pali, then proceeding on to Jodhpur and Barmer and finally entering the Jalore district.The major rivers that flow into Luni include the Jawai, Sukri, Guhiya, Bandi (Hemawas), and Jojari rivers. Jojari serves as the only tributary on the right bank; there are eight on the left side. Additionally, it is the only branch of the Luni River which does not come from the Aravalli Mountains.[22]

Wild creatures including the wolf, Indian fox, desert fox, and Indian porcupine are significant species in the area, in addition to large mammals like the Indian gazelle, blackbuck, and nilgai or blue bull. Water is an essential part of irrigation. Plants always take a lot of ground water thus ground water should be replenished. For crop irrigation, optimal water efficiency means minimizing losses due to evaporation, runoff or subsurface drainage while maximizing production.[33] An evaporation pan in combination with specific crop correction factors can be used to determine how much water is needed to satisfy plant requirements. Flood irrigation, the oldest and most common type, is often very uneven in distribution, as parts of a field may receive excess water in order to deliver sufficient quantities to other parts. Overhead irrigation, using center-pivot or lateral-moving sprinklers, has the potential for a much more equal and controlled distribution pattern.[27] Drip irrigation is the most expensive and least-used type, but offers the ability to deliver water to plant roots with minimal losses. However, drip irrigation is increasingly affordable, especially for the

home gardener and in light of rising water rates. Using drip irrigation methods can save up to 30,000 gallons of water per year when replacing irrigation systems that spray in all directions.[24] There are also cheap effective methods similar to drip irrigation such as the use of soaking hoses that can even be submerged in the growing medium to eliminate evaporation.[23]

As changing irrigation systems can be a costly undertaking, conservation efforts often concentrate on maximizing the efficiency of the existing system. [26]This may include chiselling compacted soils, creating furrow dikes to prevent runoff, and using soil moisture and rainfall sensors to optimize irrigation schedules.[19] Usually large gains in efficiency are possible through measurement and more effective management of the existing irrigation system. The 2011 UNEP Green Economy Report notes that "improved soil organic matter from the use of green manures, mulching, and recycling of crop residues and animal manure increases the water holding capacity of soils and their ability to absorb water during torrential rains",[25] which is a way to optimize the use of rainfall and irrigation during dry periods in the season.[28]

III.RESULTS

In recent years, water conservation processes by people living nearby Luni basin is as follows:-

1. Greywater Recycling Systems

The water used in most building structures is thought of in terms of clear clean water coming in, and sewage or black water going out. However, greywater is something that is in between that. In the domestic setting, greywater systems collect water from sources like baths, hand basins, and showers. This collected water is reused for washing machines, toilet flushing, and other external usages. The main idea behind greywater recovery is simply getting the most out of the water through its efficient reuse.[21]

2. Rainwater Harvesting

Rainwater harvesting systems can vary from the basic small ones, like the attachment of a water butt to a rainwater down-pipe, to the complexly designed large ones like those which collect rainwater from large areas and serve momentous numbers of properties. When it comes to domestic purposes, these systems are relevant to both commercial and domestic properties. When collected, rainwater can be used for garden irrigation, toilet flushing, and even in washing machines.

3. Efficient Irrigation Technology

Beautiful lawns and gardens demand a significant amount of water for its maintenance. In addition to indoor fixtures, efficient outdoor irrigation technologies like smart irrigation controllers can help to save a lot of water. These controllers can effectively track factors like precipitation or temperature and avoid over-watering the properties landscaping or plantations. In addition to smart irrigation controllers, one can save even more by trading out spray sprinklers for drip irrigation. These sprinkles can deliver water to your plants directly as these can be buried under the lawn.[22]

4. Water Meters

Water metering is a common term used by people when the discussion is around water conservation techniques. Water metering in simple terms is the process of measuring the water use in each residential apartment. Water meters are installed in each home of an apartment and these meters record the amount of water being used in a home for billing purpose or tracking consumption.

5. Pressure Reducing Valves

High water pressures waste a lot of water. Installing water pressure reducing valves turn out to be one great solution. These valves are can be used in residential, commercial, and institutional applications to lessen the incoming water pressure to a lower predetermined level. In this way, it protects the downstream plumbing system components as well as reduces the water consumption.

6. Insulated Pipes

Insulating all piping and storage tanks are important for any domestic hot water system today. Sadly, in most of the buildings, hot water return pipes are uninsulated or not insulated correctly. As a result, when hot water is needed, the user needs to wait at faucets or showers for the hot water to flow. This can result in significant wastage of water.

When pipes are properly insulated it ensures hot water is immediately available and when the tap is closed it supplied back to the plant, consequently reducing the energy demand of the heating unit. With insulated pipes, the user is less likely to waste by waiting for it with the taps open.[23]

7. Efficient Taps

Water-efficient taps work in two ways, they can either reduce the water flow rate through the tap or they can support the user to avoid wastage of water by automatically turning it off. These days sensor taps can be seen in almost every shopping mall or airports, these automatically sense the user's activity based on which is supplies or turns off the water flow using infrared sensors.[27]

8. Water-Saving Showers

Personal bathing accounts for a lot of water use within homes, hotels and other residential settings. Did you know, an average bath uses around 80 liters of water whereas a 5-minute shower at 10 liters per minute will use only 50 liters of water? Water-saving showerheads control the water flow rate and spray pattern of your shower. These are available in a good range of different shapes and sizes and their design can directly affect water consumption during bath.

9. Efficient Toilets

In 1995, The National Energy Policy Act mandated that all new toilets had to be low flow toilets using no more than 1.6 gallons per flush which were less than half the water used by toilets in the 1980s. Initial results were dissatisfactory but then came the pressure-assisted flushing. The principle of water-efficient toilet design and operation was the shift from removing waste by using flush water volume[26] to increasing flush water velocity. With the limited supply and continuous waste of water resource, it is crucial that we wake up and use it wisely so that we can protect and preserve our environment, minimize the effects of drought and save energy and finally the water bills. Upgrading to low flow toilets can play a crucial role in reducing water footprint.[24]

10. Waterless Urinals

Conventional toilets and urinals contain water that can harbor disease-causing bacteria to be released into the air and onto surfaces when flushed. Waterless urinals, on the other hand, have no flushing action and are designed to dry out between uses, so they can't release contamination in this way. All waterless urinals use the same basic principle: gravity carries urine from the basin through a seal in a cartridge and into the plumbing drain system, while the seal prevents odors and sewer gasses from rising up the pipe and into the restroom. The seal is typically formed by a layer of liquid sealant within the disposable cartridge insert or within an integrated trap. Like traditional water-flushing urinals, waterless urinals can be made of fiberglass, stainless steel or vitreous china. [25]

IV.CONCLUSIONS

Water is a necessity; it is the fuel for life on earth. But, even when its supply may seem abundant, it's not an infinite resource – Remember fresh potable water is scarce and that's key to our very survival. To create awareness on the global water crisis, World Water Day is observed on March 22 every year. The theme for World Water Day is 'accelerating the change to solve the water and sanitation crisis', emphasising on the need for stern action to address the water crisis.[28]

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