

Aspect of Rain Water Harvesting Techniques for Regional Planning in Pushkar (Rajasthan)



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Abstract

This paper deals with the need of rain water harvesting techniques in Pushkar region due to tourist activities or Pushkar is a pilgrimage centre of national importance and it is also the venue of internationally known cattle fair which is being patronized by government of Rajasthan which is the major attraction for foreign tourists whose number is steadily increasing in the last few years which is very important for the regional development of Pushkar whole regional plan will be depend upon the agriculture and employment. In this region the water crisis is a big problem as the water crisis continue to become severe, there is a dire need of reform water management system and revival of traditional system collecting of Rain water and conserving for future needs has traditionally been practiced in India. In this regard, this research explored the possibilities for the possibility for the rain water harvesting traditionally filtering system removed the contaminated completely in Pushkar region. This paper attempts the combination of rain water harvesting and different system of collection and filtering system. This system is likely to be a better and cheaper alternative to extract pure water from rain. Rain water harvesting is a simple and low cost technique which has been used for drinking as well as domestic use of the people.

Keywords: Rain Water Harvesting, Water Harvesting Techniques.

Introduction

Water resources are an issue of increasing concern on every level from the international to the individual. The term rain water harvesting is being frequently used these days; however, the concept of rain water harvesting is not new for India. Water harvesting techniques had been evolved and developed centuries ago. Ground water resource gets naturally recharged through percolation. But due to indiscriminate development and rapid urbanization, exposed surface for soil has been reduced drastically with resultant reduction in percolation of rain water, thereby depleting ground water resource. Rain water harvesting is the process of augmenting the natural filtration of rain water in to the underground formation by some artificial methods. Conscious collection and storage of rain water to demands of water, for drinking, domestic purposes and irrigation is termed as Rain water harvesting. There are many reasons but following are some of the important one for the rain water harvesting plan in Pushkar region. Rain water harvesting is a way to capture the rain water through various techniques:

1. Capture rain water from roof tops.
2. Capture runoff water from local streams.
3. Capture seasonal flood water.
4. Conserve water through watershed management.

Study Area

As per Hindu Mythology the Pushp was created by the falling of a lotus from lord Brahma's hand. The name Pushkar is derived from the word "Pushp". Its area is 5 sq. kms. It lies about 135 kms south west of Jaipur. Pushkar is one of the pilgrimage centers of India with 500 old temples. The holy town situated around the Pushkar Lake between two parallel of hills of Aravalli running south-west to north-east. Pushkar is located at the latitude 26°27' north and longitude 74°37' east in Ajmer district. The monsoon season is short from July to August with average rainfall running from 400-600 mm. occasionally rainfall is received during January and February. Fresh water is very precious but it is very limited in quantity so it must be preserved and conserved. Due to different human activities we need a

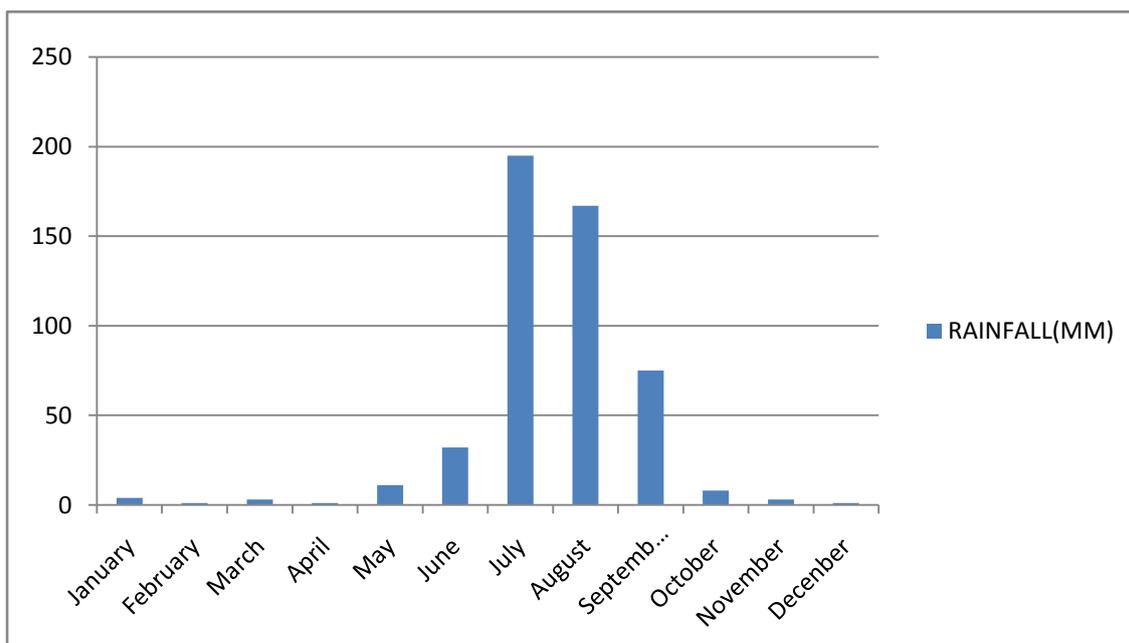
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large quantity of water as it is limited. Rain water harvesting has been practiced in areas where water exists in plenty and has provided drinking water, domestic water, water for livestock, water for small irrigation and away to increase ground water irrigation in Pushkar region. Harvested rainwater can be used

for flushing toilet and washing laundry. Here are presented data of Rainfall in this region. This data of Pushkar region shows that the highest rainfall is falling in June to September month in this month only rain water can be saved.

Months	January	February	March	April	May	June	July	August	Sept.	Oct.	Nov.	Dec.
Rainfall(Mm)	4	1	3	1	11	32	195	167	75	8	3	1

Source: Meteorological dept.



Objectives of the Study

Rain water collection is very necessary in Pushkar region for agriculture and emerging population growth. The objectives are associated technologies for runoff harvesting is highly location specific and depend on physiographic, environmental technical and socio-economic conditions. Therefore appropriate technology is developed for particular region. Increase tourism puts additional pressure on two main facilities that is water and electricity. Consumption of water is very higher for tourism sector high profile tourism region consumed about 5 more times water consumption than common people areas. This region has very high consumption of water due to tourism. Over last decades there has been an increase in tourist population, making Pushkar an important destination. The path around the lake connects all 52 Ghats to be repaired for the rain water collection.

1. To conserve surface water runoff during monsoon through checks dams.
2. To reduce soil erosion.
3. To beneficiate water quality in aquifers.
4. Build awareness on rain water harvesting in area. Influence policy makers to promote rain water harvesting and ground water recharge.
5. Integration of water use and land use policies with the main objectives of providing drinking water and its economic use for the purposes of human beings and animals.

Review of Literature

This is the easy way of collect million of water can quickly percolate into the ground instead of being allowed to evaporate and to be wasted. Rain water harvesting in Pushkar region for manifold reasons, to provide supplemental water for the district requirement, it increase soil moisture levels for greenery, to mitigate urban flooding and to improve the quality of groundwater are some of the reason why this technique is important.

1. The barefoot college (1972) to address problem of drinking water rural communities. It had created an infrastructure that collects 29 million liters of water in 470 schools and 13 villages.
2. Central ground water authority (2003) worked on ground water research.
3. DRP has been approved by CSMS for Rs. 166 crore for Pushkar on 19-12-04; Rs 37.44 crores was received for GDR.
4. The excavation work of CWR is completed at both sites as saras watinger and Pushkar also the work of PCC is completed.
5. In 2016 the MGNAREGA peoples and other NGO'S also implemented the rain water harvesting system in our own level as they aware peoples for collect rain water and used it.
6. Farmers used water for agriculture means in which they started collecting rain water in Tanka and small ponds and also rejuvenation of Bawaries (2016).

7. State government declared in 2016 that any land which is covering 300 sq. kms they have to be constructed rain water harvesting system in their roofs
8. In 2016 government marked 325 schools for making Tanka.

The watershed development programme aims at preventing degradation of land and increasing land productivity and it maintain ecological balance between land, water, plant and animal kingdom. As an innovative approach, this imitative has zero maintenance costs after its completion and is managed and controlled by the communities themselves. Rain water harvesting through collection of rain water from slopes of the village and centers as an innovative can be applied in this region which have poor, reasonable and moderate rainfall. Harvesting water can be purified by solar cooker and chlorine is added to disinfect water before consumption. Alluvial tract along river channels of Banas, Kothari, Khari and chandrabhanga are most feasible locations where shallow water table aquifers being potentially recharged by the flash food and surface runoff. These wells can be used for water supply, whereas feasible. Water is the prime need of the day to day life and harvesting system and a mechanical process can be fulfill our long lasting demand of the region.

Government and other NGO's make many projects for this technique like establishing DMAS (district metering areas) is the big project and its cost is 4.29 crores. It is completed in year 2006-07. The other project like construction of OHSR for zone 1 & 3 has completed in year 2006-07 and its total cost is 1.37 crores. Other project like rising main extension of distinct for water supply from Hisalpur is completed in 2006-08 and its estimated cost is 1.93 crores etc. many projects also constructed by MGNAREGA workers for saving rain water and reuse it. They planted more trees and plants under the " HARIT RAJASTHAN" government programme and aware every people about the uses of plant and how it can be helpful for rainfall.

Hypothesis

Rain water is collected in Johads, Ponds, Bawdies and Tanka as rain water may be contaminated, it is often not considered suitable drinking water without treatment. Rain water harvesting from roof can contain animal and bird's feces, mosses, lichens and windblown dust. The water may need to be analyzed and properly and used in a way appropriate to its safety. Ahemed (1999) stated that the following quality lists have to be conducted for stored save water at regular interval of 15 days, for a period of 4 months.

Colour, total solids, dissolved solids, hardness, acidic, Ph, fluoride.

The above mentioned test was performed in laboratory. Every day around 25 liters of water were drained out as because of a family having 5 members. Filtration of the stored for around 4 month and its quality monitored in 15 days interval. Screen covering cistern to prevent entry mosquitoes and to catch large particles that make it past the gutter cleaning. A roof washer which captured wasted water which has

washed the roof. Roof washer is consist of a long pipe for storage of initial flush of water with a trickle valve and clean out valve at the bottom only when the pipe fills with water it allowed to continue the cistern. It is very simple method. The only thing I would like to change a narrow section or trap arriving clean water. Another method is to add a light weight ball that would seal the intake when roof washer fills.

A rain water system can be as simple as a barrel connected to downspout. We connect rain barrel to the basement washing machine and get virtually all his laundry water. Rain water is soft water compare to ground water. These above models can be used in foreign countries but it can be used in Pushkar also, because Pushkar is a religious place and it can have crowd in every month. Scarcity or problem of water is the main theme because of the arrival of high numbers of tourist both domestic as well as drinking safe water. There are some harvesting techniques and methods are suggested.

1. Water resources are allocated availability of water and harvesting scheme implemented on sample area.
2. Peoples role to consume the plenty of water though different scheme.
3. Traditional knowledge, skills and material can be used to collect water and technical assistance is required from the government for the repair and maintenance of the system.
4. It provides opportunity for communities to whole together and manages their own water resource as well as productive employment for the rural.
5. Analyzing the storage system and recharge reutilizing dry wells and pumps.

Watershed development and management are integration of technology within the natural boundary of a drainage area. Water conservation and rain water harvesting is the best accomplishment when taken up on watershed management. The natural environment of Pushkar region has become increasingly degraded in the last few decades. The problem stands mainly from over development of tourist facilities and the deforestation of the surrounding area. As water shed support the entire dry land agriculture, the strength of the watershed development programmes will largely determine the growth in agriculture. The natural environment of Pushkar region becomes increasingly degraded in the last few decades. A slow sand filter well removes all suspended solids in rain water collected from the rooftops. Rain water can be harvested through pits, trenches and bore wells shafts buy directly diverting the runoff water into the existing or discussed well. Fresh water is very precious but it is very limited in quantity.

Research Methodology

I collected all data from irrigation department and other departments of Pushkar like tourism department. P.H.E.D. department of Ajmer tehsil, municipal department etc. the statistical means which are used in this research is mean, average and percentage. The present study aims at knowing the status of awareness level of man with respect to rain water harvesting. The need of water harvesting,

possible the harvested water, level of motivation among people for harvesting. I am presenting this data through different diagram and graphs like I used wheel or pie diagram for land use and occupational distribution, bar diagram for tourist arrivals in Pushkar. Graph for annual rainfall, tourist arrivals, population growth etc.

I used to make tables for the comparison of two data like comparison of population of different years, ground water level and acidic structure of water of Pushkar.

Rain harvest= Area x Amount x Efficiency

The compiled information shall be classified with a view to reach at any conclusion regarding status of awareness about rain water harvesting. The classified shall be presented in tabular as well as graphical form to make it lucid. The conservation with different concerned people and organization at different level shall be form a platform for making suggestions. Collecting of various data from blocks, magazines, dissertation and other sources which can give information of its nature, scope and importance etc. population data can be census department. To evaluate and understand the research problem, all available related to literature has been consulted, scanned and collected from various source including all personal collection and possessions, manuscripts, gazetteers etc. its detail are listed below:

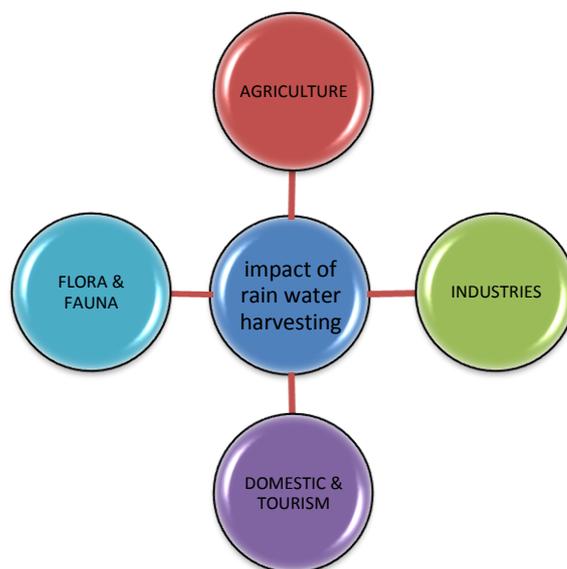
1. Total source of secondary data are census handbook.
2. The primary data on various related facts were collected from Revenue board of Ajmer tehsil. Data of rainfall, temperature and humidity were collected for meteorological department.

Conclusion

Rain water harvesting in Pushkar region is to provide supplemental water for the city's requirement

1. It increases soil moisture level for urban greenery.
2. In this region, at a household level, harvested rain water can be used for flushing toilets and washing laundry.
3. It can also be used for showering or bathing.
4. Pushkar rain water collection considering the quality water for the sake of men's health.
5. Farmers used water for agriculture means in which they started collected rain water in Tanks and small ponds and also rejuvenation of Bawaries. Make use of a natural and reduce flooding, storms water runoff erosion and fertilizers. Excellent source of water for landscape irrigation, with no chemicals such as fluoride and chlorine and any dissolved salts minerals from the soils.

Tourism has emerged as an important segment of economy with a potential to earn foreign exchange and generate large employment opportunity. Pushkar region attract the maximum number of tourist both domestic as well as foreign. It attracts 8% of the total domestic tourist and 5.6% of foreigner tourists. Rain water harvesting can be very useful for the Agriculture, Industries, Domestic & Tourism and Flora and Fauna which is shown easily in the figure given below:



Rain water harvesting is a way to capture the rain water. Rain water stores above the ground with old rain water harvesting like "Bawri", "Jhalra" etc., this techniques is used in rural areas but in cities also we need to create method to capture the rain water. There are many new system has been used for collection of rain water and purifying it and certain models and systems which is used in foreign countries. Water conservation through roof top is the most convenient form of collected rain water purifies it and it can be re use. There are many models which can be implemented in our country for betterment. Roof rain water collection can be implemented in Pushkar valley region. Rain water can be collected on the roof of the houses which are around the Ghats like:-

1. Roof of big hotels and restaurants can be used for this purpose.
2. Roof of houses and hotels are banned for the people it can be used for rain water harvesting.
3. Ghats are used for collecting water or purifying.

Two types of systems are generally used which include domestic and commercial system, both of these system are known under the term water harvesters and require only a limited amount of knowledge. The system consists of a storage tanks to store the water and piping extra pressure vessels, inline pump controllers or pressure sensitive pumps may required water purifying equipment as water purifying plants, uv lights or distillation is something added to purifying the collected water. Tourism is the main economic driver of the town, which promotes other key sector such as trade and commerce, transportation and household industries. However due to increase in foreign tourists this region mainly suffers of water availability. The cattle fair is the main economic activity in the region and this region make 80% of the annual income during the fair some data are presented below:

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Year	Indian Tourist	Foreign Tourist	Indian Tourist During Fair	Foreign Tourist During Fair
2007	1768240	76959	375000	7385
2008	1820090	86030	375000	6450
2009	1745040	75155	380000	4691
2010	1965382	79682	350000	5879
2011	2032020	69891	365000	6300
2012	2323050	70766	325000	7500
2013	2659720	62353	450000	9100

Source: Rajasthan tourism dept.

During the time of mela and other functions the consumption of water is more. People used water the water for drinking and domestic purpose and because of the main religious centre many tourist arrived here time to time. Rain water is very useful for that time also. Rain water is collected in Johads, Ponds, Bawaries and Tankas as rain water may be contaminated, it is often not considered suitable drinking without treatment. Rain water harvesting from roof can contain animal and bird's feces, mosses and lichens, windblown dust. The water may need to be analyzed properly and used in a way appropriate its safety. The main harvesting techniques are bore wells, wells, recharge pits, hand pumps, open wells and recharge shafts.



The conclusion of the study is that water is foremost thing for all of us, without water nobody can live or we can say that water is our only wealth we can leave behind for future generation. Rain water harvesting is the process in which rain water can be saved by the people and for the people and recharge again all open spaces are ideal spots for collecting rain water. Roof water collection and its new technique for purification of this water is our main motto which is very helpful for safe drinking and domestic use. Where the water was stored in the

S.No.	Types of structure	Lithology	Land cover	Slope
1.	Storage tank	Sandstone/ Limestone	Wasteland	Steep
2.	Percolation tank	Sandstone/ Quartzite	Land with scrub	Moderate
3.	Stop dam	Phyllite/ Schist	Forest	Very gentle
4.	Check dam	Granite/ Genissic	Cropping pattern	Gentle

Source: Water Resource Management

1. The above study reveals that the ground water draft is very high in Pushkar region; it has reached 122% due to indiscriminate use. Revival of ground water storage system is very useful in this region.

storage tanks and the inlet of tank may close carefully, so that the total bacteria cannot enter and grow in the tank up to the whole year or the water can use up to whole year as safe drinking water for pushkar region.

Suggestions

Farmers used water for agriculture means which they started collecting rain water in tanks and small ponds and also rejuvenated bawries. Make use of a natural resource and reduce flooding, storm water runoff erosion and fertilizers. Excellent source of water for landscape, irrigation, with no chemicals such as fluoride and chlorine and any dissolved salts minerals from the soils.

1. The watershed development programme aims at preventing degradation of land and increasing land productivity and it maintain ecological balance between land, water, plant and animal kingdom.
2. Soil & water conservation measures coupled with water harvesting help to improve the moisture availability in the soil.
3. Traditional water storing water method in Pushkar region such as tanks and bawaries should be received for conserving water. That can be used for agriculture and other purposes.
4. Extension of water saving technology each and every people can be aware of this process.
5. Small river or stream than build check dams across them to hold the rain water for usage after the rain stopped.
6. Rain water harvesting for supplemental and off season irrigation.
7. In Pushkar region has many ponds and bawaries but all are used as throwing their dumps because all these old tradition of water collection is dry and people are not aware to save water but now I saw people are active and used to collect rain water in old bawries or rejuvenate these old traditions. But I suggested some suitable structure for this region in the table given below:

2. Afforestation schemes should be implemented without the loss of time. Conduct water shed programmes and launching dry farming and a good quality lab is proposed for purifying the rain water and a water treatment plant is proposed for the treatment of rain water.

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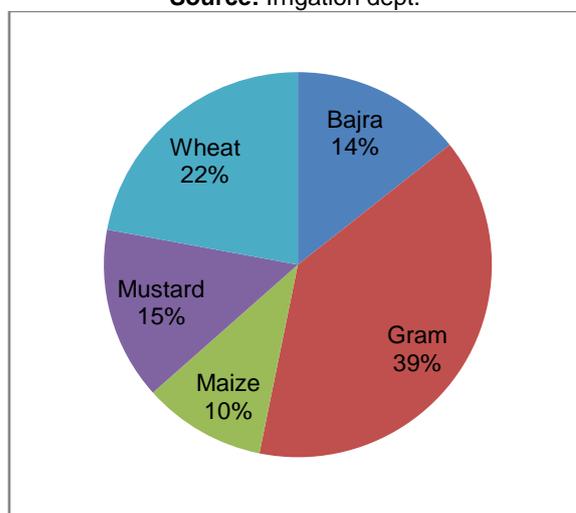
3. In the rainy season many water is collected in hillsides, we can build check dams and across them to hold the rain water. **“Paani Ko Rokho”**
4. Government recently declared that the tanks should be constructed in Pushkar region so that rain water should be collected in this tank only. The importance of rain water collection is very necessary in this region for agriculture and emerging population growth.
5. Paint the storage tanks white on the outside to keep the water inside cool and prevent the growth of bacteria. Every year the tank must be white washed neatly. This system has providing the employment to more than 20,000 villages.
6. I suggested that the roads are build sloped towards the sides, rain water falling on the road is guided to the side drains, rain water flows from on the apex to the side and collects in the sidewalks areas and subsequently flows to the storms water drains.
7. In Pushkar there are many empty plots; rain water can be harvested on plots or through recharge of ground water. The runoff from the plot could be captured by storm water drains and directed into artificial infiltration or percolations pits. The overflow from the storm water drains and infiltration system could be captured in lakes and tanks. Water of rooftops can be filtered and directly puts into an open wells or a percolation pit or a dispersion trench there are some ground water recharge methods:
 - a. Used plastic barrels.
 - b. Infiltration gallery with aggregates and sands.
 - c. Recharge soaks pits.
 - d. Trenches
 - e. Direct recharge of open wells.
8. Rain water harvesting is very suitable for Ajmer district because there is more ground water than fresh water surface water or rain water is less expensive, sustainable and reliable sources usually of high bacteriological purity instantly usable and the key to life in arid and semi arid conditions. Rain water is the purest form of water. It is not only augments a communities water resources, but is also provides good qualities water. However we need to take certain precautions to ensure that water is not polluted. The measures are:
 - a. Keep the roof or the water collection area clean before rains.
 - b. Drains off the rain water collected in the first few minutes.
 - c. Store the collected rain water subsequently in a closed container avoids sunlight because the quality of water deteriorates in the presence of sunlight and air.
 - d. Water can be kept clean over a period of 5 to 6 months in a clean container stored in an enclosed area.
9. The rooftops of different building at present do not have rain water harvesting system seeks to provide a source of water for all purpose such as drinking, laboratory use and toilet flushing. Finally, if the rain water is harvested and stored,

this will fulfill the needs of Ajmer district. Building in which storage of rain water and recharge is performed individually, building which are closed to each other and separate storage is done but recharge is combined.

10. This table shows the increase in the yield of agriculture after the water harvesting treatment Bajra increased 81% and Gram percentage is 220%. this data shows that the water harvesting techniques can increase the crop production.

Crops	Before	After	Percentage (%)
Bajra	270	490	81
Gram	150	480	220
Maize	360	570	58
Mustard	330	600	82
Wheat	632	1420	125

Source: Irrigation dept.



The conclusion of this study is that water is the fore mosting things for all of us, without water nobody can live or we can say that “water is our only wealth we can leave behind for future generation”. Rain water harvesting is the process in which rain water can be saved by the people. Rain water can be recharge again. All open spaces are ideal for collecting rain water. Instead floods, flooding storms drains and sewage pipes that are blocked with junk, we can provide simply way to recharge the underground water with rain water Rain water harvesting is a way to capture the rain water when it rains, store that water an above ground or charge the underground water and use it later.

“Save Water: Because Every Single Drop Counts”
“Don’t Throw Away The Old Bucket Until You Know Wheather The New One Hold Water”

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