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# A Review on Rooftop Rainwater Harvesting System

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**ABSTRACT:** Water is one of the most essential substances for the survival of all living things. Over 71 percent of the earth's surface is covered by water. Despite the enormous volume of water on the planet's surface, We must examine alternative and generally less demanding mechanical methods of water monitoring in order to maintain and satisfy our day-to-day water requirements. One of the most efficient strategies for satisfying such demands is rainwater harvesting. This paper reviews the methods, design of rainwater harvesting systems, and its impacts adopted in all parts of the world.

**KEYWORDS:** Rainwater harvesting, Literature review, water

## I. INTRODUCTION

As the world's population grows, so does the demand for safe drinking water. Groundwater and surface water supplies are being reduced. They are consumed quicker than they can be restored. Rainwater harvesting is an ancient method that is still used today. several countries have recognised it as a viable option source of distributed water Individually collected rainwater One of the various tools available is harvesting systems. addressing the rising demand for water Rainwater Harvesting is a safe and ecologically friendly way to addressing difficulties raised by huge projects Using a centralised water management system approach. The global population is increasing, is producing comparable issues and questions about how to solve them, provide everyone with safe drinking water. Cities are developing exponentially as land demand grows, and more forest areas are encroached and exploited for agriculture in the countryside. Small farmers in India depend on the Monsoon, which occurs from June to October and causes most of the valuable water to be lost as surface runoff. While irrigation is the most obvious answer to drought, it is also the most expensive and only benefits few people. There is growing interest in the low-cost option known as 'Rain Water Harvesting.

## II. LITERATURE REVIEW

1. **Feasibility of Rainwater Harvesting and Consumption in a Middle Eastern Semiarid Urban Area. - Ali Abbasi, Ehsan Rane, Javad Tabatabaee Yazdi, Maryam Ziyade - 2021 - MDPI Water Volume 13 Issue 15**

This paper focuses on recent developments in Middle Eastern metropolitan areas, as well as the associated soaring trend of population growth, are contemporaneous with the effects of climate change. This puts additional strain on the centralised large-scale water treatment and distribution systems. Rainwater harvesting (RWH) for domestic urban activities can be a long-term solution to meeting the increasing demand for soft water in such an arid/semiarid region. In Mashhad, Iran's second most populous city, a pilot system of rainwater drainage and storage was built to alleviate some of the city's soft water scarcity. For two years, measurements were taken at the drainage basin outlet and inside a storage tank outfitted for water harvesting.



**Major findings:**

1. Rainwater harvesting system can be beneficial in combating climate change
2. The use of proper tanks for storage of rainwater is very necessary.
3. Rainwater harvesting has a great hydrological potential if implemented properly

**2. Rain water harvesting – a review on conservation, creation and cost effectiveness - Pala Girish Kumar ,Abhirami Priyanka Pathivada, shalini veeranki - 2021 - ScienceDirect Volume 45 Part 7**

This paper investigates water as one of the classic elements of the Earth, is life's matter and matrix; mother; and medium whose usage rate is constantly increasing. Water conservation has always been a priority, and there are numerous methods for doing so. To alleviate the colloidal and scarcity of water, the desire to conserve water has advanced to the next level with the unbalanced water budget equation. Rainwater Harvesting has a prominent role to play in this area of interest, as it sites the collection and utilisation of rainwater, thereby reducing runoff. Many research papers and publications on RWH technologies have been useful. The purpose of this paper is to debunk various myths and methodologies associated with RWH.

**Major findings:**

1. Their study showcases the requirement and the emergency of adopting RWH as a conservation method of water resources
2. Their present study also highlights RWH as the feasible method to fight the scarcity of water
3. Their study aims in portraying the need for adopting RWH as a common practice in day to day life.

**3. Optimal sizing of rainwater harvesting systems for domestic water usages: A Systematic literature review - Mary Semaan , Susan D, Michael Garvinc, Nare Ramakrishn, Annie Pearce - 2020 - ScienceDirect Volume 6**

This paper proposes rainwater harvesting systems (RWHS) are becoming increasingly popular due to their ability to relieve water pressure on centralised systems, minimise or delay rainfall runoff, and fit relatively easily into both centralised and decentralised infrastructure organisations. Undersizing RWHS results in systems that are unable to provide a sufficient, reliable source of water, whereas oversizing increases capital costs with limited marginal benefits and poses potential water quality risks.

We conduct a systematic literature review to assess the state-of-the-art in the field of domestic rainwater harvesting system optimization. Although storage sizing is identified as the most important goal of optimization, sizing for cost is the most commonly implemented outcome of optimization.

**Major findings:**

1. The quality of collected rainwater can be improved using scientific filtration processes.
2. The evaporation of water from roofs can be minimised by intelligent sensors.
3. The right quality and size of tanks which would be used for storage of rainwater is very important.

**4. Effective utilization, storage and treatment of rain water for drinking purpose at ADYPU Campus - Sahil Shaikh, Adnan Siddiqui, Ronald Francis, Shreedhar Renuse, Vishwajeet Kadlag- 2020 - OPEN ACCESS INTERNATIONAL JOURNAL OF SCIENCE AND ENGINEERING Volume 5, Issue 9**

In this paper the current study attempted to investigate the current state of water requirements and proposed rooftop rainwater harvesting potential on the college campus. constructing and ADYPU's campus in Lohegaon, Pune, and the average annual rainfall in the study area. In the current study, 763 mm is used. The proposed study relies entirely on primary data collected through fieldwork and secondary sources such as the Socio-Economic Review and District Statistical Abstract of Pune, as well as numerous published and unpublished thesis, article books, and so on. The daily



water consumption per capita. The amount needed is calculated as the number of people multiplied by 2 litres. The ADYPU campus spans 100 acres and has a rooftop surface area of 18172 m<sup>2</sup>.

**Major findings:**

1. The authors of this paper designed rooftop rain water harvesting system for ADYPU campus.
2. They also identified components and filtration methods for rooftop rainwater harvesting.
3. They estimated the cost of building such project in ADYPU campus.
5. **Rain water harvesting an emerging technology in changing condition a case study of graphic era university -Nitin Mishra, Amit Kumar Sharma, Sanjeev Kuma - 2019 - INTERNATIONAL JOURNAL OF RESEARCH SCIENCE & MANAGEMENT - ISSN: 234-5197 Impact Factor: 2.715**

The author surveyed that India has frequently invested heavily in rainwater harvesting as a frantic response to problems of water scarcity and the resulting hardships faced by both urban and rural communities. In comparison to investments in large water resource systems, these efforts, on the whole, lack hydrological planning and sound economic analysis: research on the impact of local water harvesting/groundwater recharge activities in India is extremely limited. This paper identifies six critical issues in rainwater harvesting efforts in India's water-stressed regions. First, there is no emphasis on potential local supplies and the demand they must meet: in most water scarce regions, local supply potential is low, which is exacerbated by poor reliability, and demand far exceeds supply potential.

**Major findings:**

1. Rainwater harvesting system can be beneficial in combating climate change
2. The use of proper tanks for storage of rainwater is very necessary.
3. Rainwater harvesting has a great hydrological potential if implemented properly.
6. **Rainwater Harvesting for Agricultural Irrigation: An Analysis of Global Research - by Juan F. Velasco-Muñoz, José A. Aznar-Sánchez, Ana Batlles-de la Fuente, María Dolores Fidelibus - 2019 - MDPI Water Volume 11 Issue 7**

The author proposed that rainwater harvesting is a promising alternative that has been studied by various disciplines in recent years in the context of scarce agricultural water resources. The dynamics of global research on rainwater harvesting for agricultural irrigation over the last two decades are examined in this article. This was accomplished through qualitative systematic analysis and quantitative bibliometric analysis. The findings indicate that this area of study is becoming increasingly important in irrigation research. The most relevant subject areas are environmental sciences, agricultural sciences, and biological sciences. The journals that have published the most articles on the subject are Agricultural Water Management, Physics and Chemistry of the Earth, and Irrigation and Drainage.

**Major findings:**

1. New technology can be used for better output in rainwater harvesting system.
2. By studying the existing technology and further development of new technology can lead to better results in the process of collection, storage and consumption of rainwater.
3. Rural areas are more likely to benefit from this technique
7. **Rain water harvesting, conservation and management strategies for drought –prone tahsils of Jalgon district Maharashtra state, India: urban and rural sectors - Dr. Pallavi, Namdev Arjun - 2019 International Journal of Development Research - Volume: 08 Article ID: 16289**

In this paper the author described water as our most valuable natural resource, and most of us take it for granted. We are becoming increasingly aware of the importance of water to our survival and its scarcity. Humans require water for a variety of reasons. Water covers the majority of the earth's surface, accounting for approximately 71%. Out of the total



volume of water available on the earth's surface, 97 percent is saline water, 2 percent is ice and glaciers, and only 1 percent is fresh and potable water. In terms of average annual rainfall, India ranks first in the world.

**Major findings:**

1. The technique of rainwater harvesting is very for drought prone semi arid regions.
2. Economical methods of are also available for rural areas.
3. The study of rainfall data and geology of the region is important for considering the right method for implementation of rainwater harvesting systems.

**8. Water scarcity : A major concern for citizens - Dr. Bidyut Jyoti Gogoi - 2019 - International Journal of Civil Engineering and Technology (IJCIET) Volume 10, Issue 06**

The researcher wishes to comprehend the gravity of water scarcity in India, with a focus on north-eastern India, water sources used by residents, and ground water conditions.

Water is one of the most important elements for all forms of life to survive. Water covers nearly 71 percent of the earth's surface. Nonetheless, despite the large amount of Only 3% of the total water available on the earth's surface is fresh water. water. Only 0.4 percent of this 3 percent is usable and drinkable water, leaving us with is to be shared by 7.7 billion people. Natural water distribution inequalities Throughout the world, we see both very wet and very dry geographic regions. The growth in Freshwater demand has increased in recent years as a result of industrialization and human needs. Resulting in water scarcity There are a number of geographical areas where adequate there is no drinking water.

**Major findings:**

1. The researcher wants to understand the gravity of water scarcity in India with a focus on north east India, the water sources utilized by inhabitants and the groundwater condition.
2. The study is based on secondary research which probes on the literature published by various agencies.
3. The data from the census 2011 is used for analysis and understanding the sources of water used by the people of the north east region.

**9. Climate reality India. A rainwater harvesting technique in PMC - Col. Shashikant Dalvi - 2018**

In this project the author completed in December 2018, with 5 crore litres of rain water annually recharging the Pune city's ground water table via the rooftops of PMC buildings. The Pune Commissioner then entrusted me with providing the necessary technical support for the project's successful completion. I designed the RWH systems, trained the appropriate personnel, and provided guidance and supervision during implementation. With their direct involvement on the ground, Mr Khandave, Head of the Bhawan Department, PMC, and his team were extremely proactive in providing necessary assistance. With this, PMC became the state's first municipal corporation to successfully implement such a green project. This project will serve as the gold standard for the implementation of similar projects across the country.

**Major findings:**

1. Rainwater harvesting system can be useful for water management in schools.
2. Effective use of available water can help during summer season
3. Rainwater harvesting system is very economical and convenient system if implemented properly.

**10. Design of Rooftop Rainwater Harvesting in Nimgaon village Dr. P.D. Sabale, Prof. S. J. Yadav , Chetan Bangale , Ajay Kharat , Chandradeep Patil , Sagar Waghule - IJERT - Volume 07, Issue 04**

This paper shows the technical aspect of this project, that is rainwater harvesting from rooftops in catchment areas such as Nimgaon Tarfe Mhalunge, Junnar, and Pune. First and foremost, the site has been chosen in the foothills of the Sahyadri Mountains, where a steep slope exists where runoff flows, and the goal of this project is to collect and store



that water, as well as to utilise it by providing proper filtration. The project begins by collecting and studying some important studies on rainwater harvesting. Following proper field planning work, Nimgaon was visited to properly visualise the situation of Nimgaon village and to measure the dimension of the roof catchment area. Then, other necessary data are gathered, such as hydrological rainfall data and temperature.

**Major findings:**

1. The technical aspect of this project is rainwater harvesting collected from rooftop which is considered to be catchment areas Nimgaon Tarfe Mhalunge, Junnar, Pune.
2. The aim of this project is to collect and store that water and utilize the water by providing proper means of filtration.
3. The project starts by collecting some important researches on rainwater harvesting and studied them

**III.CONCLUSION**

By examining the previous published literature we came to know about various rain water harvesting implemented all over the world. The collected rain water can greatly reduced water dependence on ground water techniques the collected rain water can be used for various domestic purposes like gardening cleaning, flushing toilets, washing cars etc. Water is a valuable resource and its our duty to conserve it. The rainwater harvesting technique can be a good measure to solve water scarcity problems in dry, semi arid regions. The cost of rainwater varies according to size of the collection tank and filtration methods.

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