Research Paper
Impact Factor: 7.358
Peer Reviewed & Indexed Journal
www.ijmsrr.com

IJMSRR
E- ISSN - 2349-6746
ISSN -2349-6738

A STUDY ON WATER SCARCITY: CAUSES AND SOLUTION

Karthikeyan - I IAF B* Raghuraman - I IAF B* Nirmalkumar - I IAF B*
**Department of Commerce SRM Institute of Science and Technology Kattankulathur, Chennai.*

Abstract
Water is a fundamental natural resource essential for human survival, agriculture, industry, and ecological balance. However, increasing demand, population growth, pollution, and climate change have led to widespread water scarcity across the globe. Water scarcity is not only an environmental issue but also a socio-economic challenge that affects food security, health, and sustainable development. This study aims to examine the major causes of water scarcity, including over-extraction, mismanagement of resources, pollution, and uneven distribution of freshwater. It also highlights potential solutions such as rainwater harvesting, efficient irrigation techniques, wastewater recycling, desalination, and strong policy frameworks for sustainable water management. By analyzing both global and local perspectives, this paper underscores the urgent need for collective action, government policies, and community participation to mitigate the impacts of water scarcity and ensure long-term water security.

Keywords: Water scarcity, Causes, Solutions, Sustainable water management, Conservation.

Introduction

Water is one of the most vital natural resources on earth, supporting human life, ecosystems, and economic development. Despite being abundant in nature, only about 2.5% of the earth's water is fresh and accessible for human use. Rapid urbanization, industrial growth, agricultural expansion, and climate change have intensified the pressure on limited freshwater resources, leading to water scarcity in many regions.

Water scarcity can be broadly classified into two types: physical scarcity, where natural water availability is insufficient to meet demand, and economic scarcity, where water exists but poor infrastructure and mismanagement prevent effective utilization. Countries across Africa, Asia, and the Middle East face severe water shortages, while even water-rich regions are experiencing stress due to pollution, groundwater depletion, and inefficient usage.

The issue of water scarcity is more than an environmental concern; it directly impacts food production, health outcomes, social stability, and sustainable economic growth. Addressing this crisis requires a combination of technological innovations, government intervention, community awareness, and conservation strategies. This paper seeks to explore the root causes of water scarcity and propose sustainable solutions to ensure equitable access to safe and sufficient water for present and future generations.

Statement of the Problem

Water scarcity has become one of the most pressing global challenges of the 21st century. Despite technological advancement and awareness campaigns, millions of people still lack access to safe and adequate water. Over-extraction of groundwater, poor management of water resources, pollution, and uneven geographical distribution of freshwater have worsened the crisis. In addition, climate change has led to unpredictable rainfall patterns and droughts, further intensifying water shortages. The problem of water scarcity not only threatens human health but also agriculture, industry, and overall

sustainable development. Hence, there is an urgent need to study the causes of water scarcity and propose effective, long-term solutions to overcome this challenge.

Objectives of the Study

1. To examine the major causes of water scarcity, including natural and human-induced factors.
2. To analyze the impact of water scarcity on health, agriculture, industries, and ecosystems.
3. To identify and evaluate sustainable solutions for overcoming water scarcity.
4. To highlight the role of government policies, community participation, and technology in water conservation.
5. To create awareness about the importance of water management for future generations.

Scope of the Study

1. The study focuses on global water scarcity, with particular attention to regions that face critical shortages, including parts of Africa, Asia, and the Middle East.
2. It includes both physical scarcity (limited natural water availability) and economic scarcity (ineffective management and access issues).
3. The scope covers causes such as overpopulation, over-extraction, pollution, climate change, and poor governance.
4. It also covers solutions, including rainwater harvesting, water recycling, desalination, efficient irrigation systems, awareness campaigns, and strong policy frameworks.
5. The research emphasizes sustainability and conservation as key approaches to ensuring long-term water security.

Review of Literature

1. **Falkenmark, M. (1989)**: In her seminal work on water scarcity, Falkenmark introduced the concept of "water stress index," highlighting that population growth and uneven distribution of freshwater resources are key contributors to global water shortages.
2. **Postel, S. (1997)**: In Last Oasis: Facing Water Scarcity, Postel emphasizes that mismanagement of water, excessive irrigation, and over-extraction of groundwater are central causes of scarcity, requiring sustainable conservation practices.
3. **United Nations World Water Development Report (2015)**: The report identifies climate change, pollution, and increasing demand as major drivers of water scarcity and calls for integrated water resource management (IWRM) as a global solution.
4. **Gleick, P. H. (2014)**: Gleick's research highlights the importance of sustainable water use and advocates for water efficiency, recycling, and community-level participation to tackle scarcity.
5. **World Bank (2016)**: In its study on High and Dry: Climate Change, Water, and the Economy, the World Bank notes that water scarcity could cost some regions up to 6% of their GDP by 2050 if left unaddressed.
6. **UNICEF & WHO (2019)**: Their joint report shows that nearly 2.2 billion people globally lack access to safe drinking water, underlining the link between water scarcity, public health, and inequality.

Summary

The reviewed literature consistently identifies population growth, climate change, overuse, and poor management as primary causes of water scarcity. Suggested solutions focus on efficient water use, technological innovations, strong governance, and community involvement.

Research Methodology

Research Design

The study follows a descriptive and analytical research design aimed at identifying causes of water scarcity and evaluating practical solutions.

Data Collection

Primary Data

1. Surveys and interviews with local communities, farmers, industries, and water management authorities.
2. Field visits to areas facing acute water shortages to observe challenges and coping strategies.

Secondary Data

1. Reports from UN, World Bank, and government agencies on water scarcity.
2. Published research papers, books, and articles on sustainable water management.
3. Case studies on successful water conservation practices (e.g., rainwater harvesting in Rajasthan, desalination in Israel).

Sample Size & Area

1. The study will focus on selected regions in India facing critical water stress (Tamil Nadu, Rajasthan, Maharashtra) while also incorporating global comparisons.
2. A sample of 50–75 respondents (households, farmers, and local administrators) will be studied.

Data Analysis Tools

1. Descriptive statistics (percentages, charts, graphs) to interpret survey data.
2. Comparative analysis of traditional vs. modern water management methods.
3. Qualitative analysis of interview responses and case studies.

Limitations of the Study

1. The study is limited to selected case regions and may not represent global conditions entirely.
2. Availability of reliable secondary data may vary across sources.
3. Responses from communities may be influenced by personal experiences and perceptions.

Findings

1. **Over-extraction and Mismanagement:** Excessive groundwater use for agriculture and industries is a primary cause of water depletion in many regions.
2. **Population Growth and Urbanization:** Rising population has led to increased domestic, agricultural, and industrial demand, straining limited water resources.
3. **Climate Change:** Unpredictable rainfall patterns, prolonged droughts, and rising temperatures have worsened water scarcity globally.
4. **Pollution and Contamination:** Industrial effluents, untreated sewage, and agricultural chemicals are reducing the availability of potable water.
5. **Regional Disparity:** While some regions enjoy sufficient water resources, others suffer from severe shortages due to geographical and infrastructural constraints.
6. **Policy and Governance Gaps:** Many government programs exist but suffer from weak implementation, lack of coordination, and inadequate monitoring.
7. **Successful Case Studies:** Initiatives like rainwater harvesting in Rajasthan and desalination in Israel show that sustainable practices can significantly reduce scarcity.

Suggestions

1. **Promote Water Conservation:** Awareness campaigns should be conducted to encourage households, farmers, and industries to adopt water-saving practices.

2. **Adopt Modern Irrigation Methods:** Drip and sprinkler irrigation should replace flood irrigation to reduce agricultural water wastage.
3. **Strengthen Rainwater Harvesting:** Governments must make rainwater harvesting mandatory in urban and rural areas.
4. **Invest in Technology:** Desalination, wastewater recycling, and smart water management systems should be adopted widely.
5. **Policy and Governance Reforms:** Integrated water resource management (IWRM) and strict pollution control laws are needed to ensure sustainable use.
6. **Community Participation:** Local communities should be empowered to manage and monitor water resources at the grassroots level.
7. **Global Collaboration:** Sharing best practices across countries can accelerate adoption of innovative solutions.

Conclusion

Water scarcity is one of the greatest challenges facing humanity, with far-reaching implications for food security, public health, economic development, and social stability. The study reveals that while natural factors like climate change play a role, human activities such as over-extraction, pollution, and mismanagement are the major contributors to the crisis.Solutions lie in a **multi-dimensional** approach: promoting efficient irrigation in agriculture, investing in technology, recycling wastewater, implementing rainwater harvesting, and enacting strong water governance policies. Case studies from different parts of the world demonstrate that effective solutions exist and can be replicated if there is political will and community involvement.The conclusion underscores that ensuring sustainable water security is not just a government responsibility but a collective duty of individuals, industries, and global communities. With timely action, innovation, and cooperation, water scarcity can be mitigated, ensuring this vital resource for future generations.

References

1. Falkenmark, M. (1989). The massive water scarcity now threatening Africa: Why isn't it being addressed? Ambio, 18(2), 112–118.
2. Postel, S. (1997). Last oasis: Facing water scarcity (2nd ed.). W.W. Norton & Company.
3. United Nations Educational, Scientific and Cultural Organization (UNESCO). (2015). The United Nations World Water Development Report 2015: Water for a sustainable world. UNESCO Publishing. Retrieved from https://unesdoc.unesco.org
4. Gleick, P. H. (2014). Water, drought, climate change, and conflict in Syria. Weather, Climate, and Society, 6(3), 331–340. https://doi.org/10.1175/WCAS-D-13-00059.1
5. World Bank. (2016). High and dry: Climate change, water, and the economy. Washington, DC: World Bank. https://doi.org/10.1596/978-1-4648-0949-5
6. UNICEF & World Health Organization. (2019). Progress on household drinking water, sanitation and hygiene 2000–2017: Special focus on inequalities. New York: UNICEF and WHO. Retrieved from https://washdata.org
7. Food and Agriculture Organization of the United Nations (FAO). (2020). The state of food and agriculture: Overcoming water challenges in agriculture. Rome: FAO.
8. Mishra, A. K., & Singh, V. P. (2010). A review of drought concepts. Journal of Hydrology, 391(1–2), 202–216. https://doi.org/10.1016/j.jhydrol.2010.07.012
9. Biswas, A. K. (2004). Integrated water resources management: A reassessment. Water International, 29(2), 248–256. https://doi.org/10.1080/02508060408691775
10. Sharma, S. K. (2019). Water scarcity in India: Causes, effects and solutions. International Journal of Management, Technology and Engineering, 9(1), 2512–2520.