World Academy of Science, Engineering and Technology
International Journal of Environmental and Ecological Engineering
Vol:17, No:10, 2023

Addressing Water Scarcity in Gomti Nagar, Lucknow, India: Assessing the Effectiveness of Rooftop Rainwater Harvesting Systems

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Abstract : Water scarcity is a significant challenge in urban areas, even in smart cities (Lucknow, Bangalore, Jaipur, etc.) where efficient resource management is prioritized. The depletion of groundwater resources in Gomti Nagar, Lucknow, Uttar Pradesh, India is particularly severe, posing a significant challenge for sustainable development in the region. This study focuses on addressing the water shortage by investigating the effectiveness of rooftop rainwater harvesting systems (RTRWHs) as a sustainable approach to bridge the gap between groundwater recharge and extraction. The aim of this study is to assess the effectiveness of RTRWHs in reducing aquifer depletion and addressing the water scarcity issue in the Gomti Nagar region. The research methodology involves the utilization of RTRWHs as the primary method for collecting rainwater. RTRWHs will be implemented in residential and commercial buildings to maximize the collection of rainwater. Data for this study were collected through various sources such as government reports, surveys, and existing groundwater abstraction patterns. Statistical analysis and modelling techniques were employed to assess the current water situation, groundwater depletion rate, and the potential impact of implementing RTRWHs. The study reveals that the installation of RTRWHs in the Gomti Nagar region has a positive impact on addressing the water scarcity issue. Currently, RTRWHs cover only a small percentage of the total rainfall collected in the region. However, when RTRWHs are installed in all buildings, their influence on increasing water availability and reducing aquifer depletion will be significantly greater. The study also highlights the significant water imbalance in the region, emphasizing the urgent need for sustainable water management practices. This research contributes to the theoretical understanding of sustainable water management systems in smart cities. By highlighting the effectiveness of RTRWHs in reducing aquifer depletion, it emphasizes the importance of implementing such systems in urban areas. Data for this study were collected through various sources such as government reports, surveys, and existing groundwater abstraction patterns. The collected data were then analysed using statistical analysis and modelling techniques to assess the current water situation, groundwater depletion rate, and the potential impact of implementing RTRWHs. The findings of this study demonstrate that the implementation of RTRWHs can effectively mitigate the water scarcity crisis in Gomti Nagar. By reducing aquifer depletion and bridging the gap between groundwater recharge and extraction, RTRWHs offer a sustainable solution to the region's water scarcity challenges. Widespread adoption of RTRWHs in all buildings and integration into urban planning and development processes are crucial for efficient water management in smart cities like Gomti Nagar. These findings can serve as a basis for policymakers, urban planners, and developers to prioritize and incentivize the installation of RTRWHs as a potential solution to the water shortage crisis.

Keywords : water scarcity, urban areas, smart cities, resource management, groundwater depletion, rooftop rainwater harvesting systems, sustainable development, sustainable water management, mitigating water scarcity
Conference Title : ICWSDM 2023 : International Conference on Water Scarcity and Drought Management
Conference Location : Barcelona, Spain
Conference Dates : October 23-24, 2023