

Abstract

Water, a vital resource, is essential for urban growth, community development, and environmental sustainability, with its management profoundly affecting both humans and ecosystems. Traditional Water Management Systems (TWMS) have historically sustained communities and played a crucial role in sustaining civilizations for centuries, particularly in arid and semi-arid regions. This study examines the role of TWMS in climate change adaptation through the case study of Jaipur, the capital city of state of Rajasthan, India. Situated in a semi-arid region with limited surface water resources and erratic rainfall patterns, Jaipur historically developed ingenious water management strategies, such as stepwells (baodis), tanks, canals, and rainwater harvesting structures, to cope with water scarcity. While these systems were once a foundation for city's water supply, the growing urbanization and population pressures in Jaipur have led to a decline in the use and maintenance of the traditional systems.

This research aims *to analyse the role of Traditional Water Management System (TWMS) in mitigating the impacts of climate change and enhancing water security for local communities in Jaipur, India*. The specific research objectives of the study are framed as follows:

- I. To study the historical evolution and development of water management systems in Jaipur.
- II. To evaluate the existing condition and functional status of TWMS in Jaipur.
- III. To assess the impacts of climate change on Jaipur and examine the role of traditional water structures in climate change adaptation.
- IV. To identify and propose context-specific interventions and adaptive strategies to revitalize TWMS for improved climate resilience and sustainable water management.

The study utilized a mixed-methods approach, integrating both qualitative and quantitative techniques to investigate the role of TWMS in enhancing climate resilience in Jaipur, Rajasthan. To comprehensively address the research objectives, two extensive field visits (Phase I: April-May 2023 and Phase II: July-August 2024) were undertaken in the city of Jaipur, Rajasthan, India, supplemented by data collection from relevant institutions in New Delhi, the capital city of India. During these field visits, secondary data collection and reconnaissance level documentation of the traditional water infrastructure were conducted. Long-term precipitation, temperature and groundwater level records were obtained to analyse spatial and temporal trends. To systematically document and assess the TWMS, a primary survey questionnaire was designed and administered during field visits. In addition, FLIR thermal camera was used during field investigations to capture thermal imagery of selected structures. Archival records, community discussions and expert conversations were also carried out during the field visits.

The findings of the study provide a comprehensive understanding of the evolution and development of water management system of Jaipur during its establishment, pre-independence and post-independence period. It can be observed that the introduction of piped water supply marked the beginning of gradual decline of use of traditional water structures. The structural and functional documentation of the TWMS revealed that none of the structures originally built to supply drinking water to the city currently serve that purpose. The transition

of Jaipur's water supply system from a self-sustained, traditionally managed system within the planned walled city to its current dependence on modern infrastructure has been studied in detail to determine when and how this paradigm shift occurred. The decadal changes in temperature and rainfall patterns in Jaipur highlight that over the decades Jaipur is becoming drier and warmer. To study the impact of climatic shifts on Jaipur, groundwater level monitoring and land surface temperature mapping was carried out. It was observed that the average groundwater level has significantly decreased in the last three years and the traditional water structures can play an important role in its recharge as they are primarily located in regions exhibiting high groundwater fluctuation. The analysis of LST mapping determines that there are no consistent or uniform pattern associated with TWMS at the macro city scale. However, at micro level, a notable difference in surface temperatures between the upper and lower sections of traditional water structures. It highlights the importance of these structures in adaptation to micro-climate management.

As the research outlines the findings previously mentioned, it will guide you through a journey from history to modern times and into the future, providing an overview of Jaipur's traditional water management systems. It will emphasize how these infrastructures, once essential to communities, have suffered decline for self-centred motives. However, it will also suggest that they still hold the potential for restoration and could assist us in addressing the challenges posed by climate change in the future.