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Planning Interventions to Develop Blue Green Infrastructure on the Verge of Water Sensitivity: A Case of Lucknow, Uttar Pradesh

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Abstract: *This abstract emphasises the significance of planning interventions to construct blue-green infrastructure in Lucknow, Uttar Pradesh, on the border of water sensitivity. Blue-green infrastructure is a sustainable method that blends natural and engineered systems to manage water resources, boost urban resilience, and improve the quality of life in metropolitan environments. Due to urbanisation and climate change, Lucknow, the capital of Uttar Pradesh, is confronted with considerable water sensitivity challenges. Through the deployment of blue-green infrastructure, this research aims to provide planning strategies that successfully solve the water sensitivity concerns in Lucknow. The interventions emphasise the integration of green areas, water management systems, and sustainable drainage systems in order to reduce floods, improve water quality, and boost ecosystem services. The findings of this study contribute to the expanding body of information about the construction of blue-green infrastructure in water-sensitive metropolitan regions. The recommended planning interventions offer policymakers, urban planners, and local authorities with a road map for promoting resilience and sustainable development in Lucknow.*

Keywords: Blue-green infrastructure, Water sensitivity, Sustainable development, Stormwater management, Water management

I. INTRODUCTION

Blue-green infrastructure refers to the incorporation of water management and other environmental characteristics into the urban and suburban planning process. It is a notion that has received much attention in recent years as a sustainable approach to solving the complicated issues cities and municipalities confront in managing water resources. By combining the built and natural surroundings, blue-green infrastructure seeks to make cities more habitable and sustainable.

The significance of studying blue-green infrastructure rests in its capacity to offer a variety of advantages to urban and suburban areas. Blue-green infrastructure projects, such as green roofs, rain gardens, permeable pavements, sponge areas, and built wetlands, can aid in storm water management and water quality improvement. In addition, these initiatives can lessen the influence of heat islands, enhance air quality, and encourage biodiversity.

As urbanisation continues to expand, the demand for sustainable solutions that can mitigate the environmental effects of urbanisation is intensifying. In addition to managing water resources, blue-green infrastructure also provides additional advantages, such as enhanced air quality, biodiversity, and recreational places, to solve these concerns.

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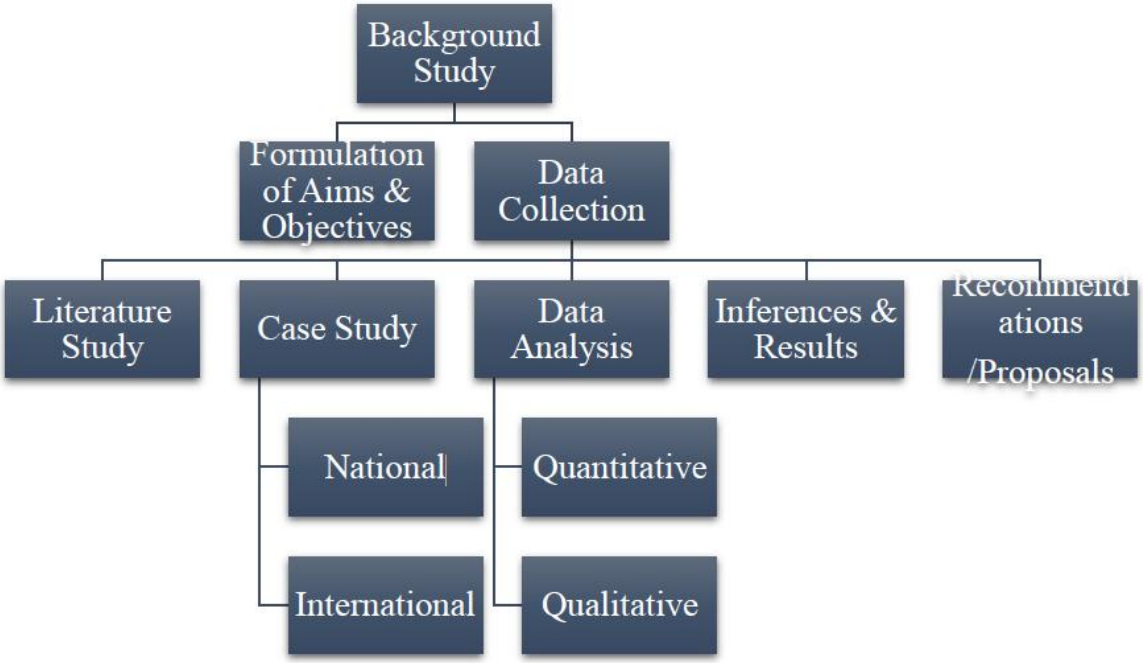
II. METHODOLOGY



III. LITERATURE REVIEW

3.1 Urban Water Management Challenges in China

China has seen fast urbanisation, a steep increase in urban population, and a dramatic expansion of urban area since the 1980s. Rapid urbanisation frequently causes major water problems. In expanding cities, vast tracts of absorbent green land have been turned into impermeable asphalt. The present urban stormwater drainage systems in several Chinese cities, such as Beijing and Wuhan, date back to the Qing Dynasty1 and are deemed inadequate. These drainage systems are severely deteriorated and contribute significantly to water pollution in rivers, streams, and other bodies of water. In addition, it is believed that drainage systems in half of China's metropolitan areas do not fulfil national flood prevention criteria.

3.2 Chinese Sponge City Programme

The "sponge city" concept was developed in China to reshape the relationship between people, water, and the city. It was inspired by international concepts such as "Low Impact Development" (United States), "Water Sensitive Urban Design" (Australia), "Sustainable Urban Drainage Systems" (United Kingdom), and "Low Impact Urban Design & Development" (New Zealand). In 2013, Chinese President Xi Jinping stated that, in a new form of urbanization6, cities should be designed to absorb rainfall and utilise natural forces to collect, penetrate, and cleanse rainwater like a sponge. Since then, "sponge city" has steadily entered the public consciousness.

3.3 Objective and Construction Goals

In addition to the primary aims, Wuhan has established four building targets for the sponge city project based on local conditions in an effort to relieve water logging issues:

1. Light precipitation shall percolate through the soil.
2. Heavy precipitation shall not result in water logging.
3. To reduce water contamination
4. To reduce the impact of heat island

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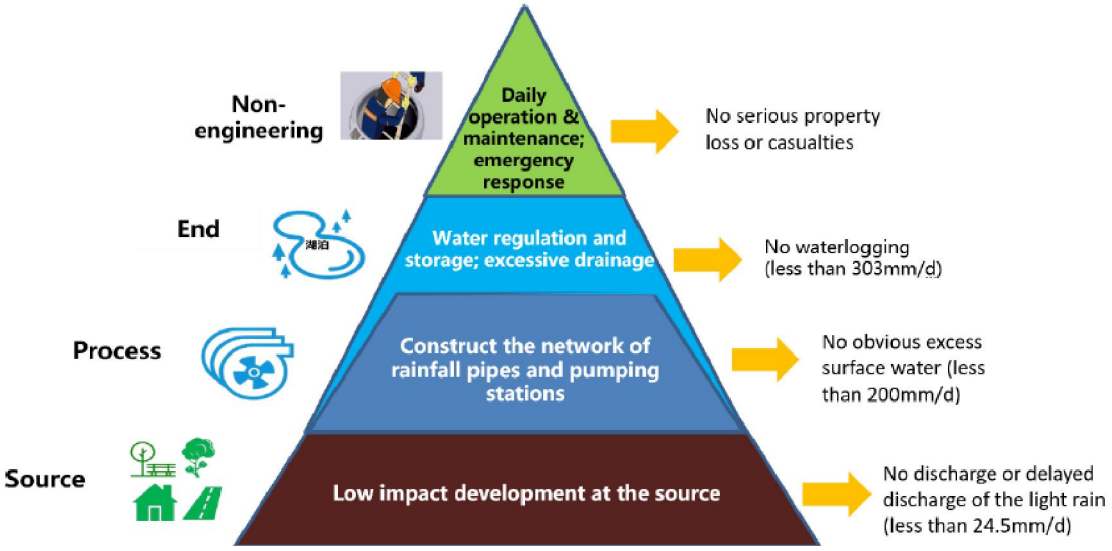

Figure 1: The management ideas of sponge city construction (adapted from KANG Dan 202015, permissions from the Wuhan Urban and Rural Construction Bureau)

IV. CASE STUDIES

4.1 Madurai

The inhabitants and physical infrastructure of Madurai are already affected by a variety of climate-related threats, including floods. Madurai is situated in a warm-humid climate zone and has a hot, dry climate with sporadic and irregular precipitation. In recent years, areas of the city have flooded due to the monsoon's heavy precipitation. Periyar Bus Stand Region, Railway Colony, and the area near Madura Coats on the northern bank of the Vaigai River are most affected. Simakkal, the area near the Amirtham Theatre, the area surrounding the Tallakulam Perumal Kovil temple, Kattabomman Nagar, Narimedu, and the Meenakshipuram-Bibikulam region are also susceptible to flooding.

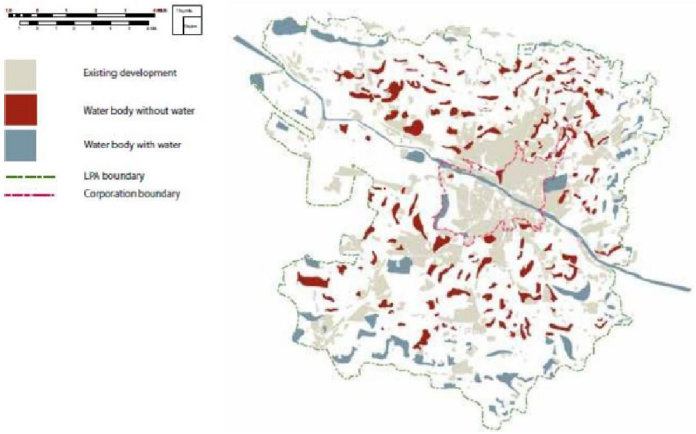

Figure 2: Blue-green infrastructure: a way of integrating

V. DATA ANALYSIS

Several essential factors are explored in an analysis of interventions to construct blue-green infrastructure on the border of water sensitivity in Lucknow, Uttar Pradesh.

Assess the water sensitivity of Lucknow by assessing historical flood events, groundwater levels, drainage patterns, and climate change risk. This evaluation establishes a baseline comprehension of the prevalence and severity of water sensitivity in the city.

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Priority Areas Identification Identify the parts of Lucknow that are most vulnerable to water sensitivity, such as low-lying places prone to flooding or locations with insufficient drainage. This study assists in prioritising initiatives and identifying regions where blue-green infrastructure may have the greatest impact.

Data Integration: Integrate pertinent datasets, such as maps of land use, hydrological data, population density, and infrastructural networks. By merging these statistics, the links between land use patterns, water sensitivity, and existing infrastructure may be identified, hence facilitating the selection of relevant measures.

Blue-Green Infrastructure Planning: Create a comprehensive strategy for interventions in blue-green infrastructure in Lucknow. This plan should incorporate a variety of measures, including green areas, rainwater harvesting systems, wetland habitats, permeable pavements, and sustainable drainage. Consider feasibility, cost-effectiveness, and long-term viability when choosing and designing solutions.

Multi-Criteria Analysis: Utilize a framework for multi-criteria analysis to assess various intervention alternatives based on criteria such as flood mitigation, water quality improvement, biodiversity enhancement, social equality, and economic feasibility. This approach assists in prioritising solutions based on their ability to successfully solve water-sensitive concerns.

It is feasible to construct successful planning interventions for blue-green infrastructure in Lucknow, Uttar Pradesh, by undertaking a complete study that takes into account these factors. The research gives a methodical strategy for addressing water-sensitive issues, enhancing urban resilience, and promoting sustainable urban growth.

VI. CONCLUSIONS & PROPOSALS

The effectiveness of the sponge programme is contingent on the systematic and comprehensive regulation of water processes. The combination of non-engineering measures and engineering measures, including blue and green infrastructure to "let nature do the work" and grey infrastructure to reduce excessive rainfall, constitutes the top-level design of sponge cities as well as coordination with other urban plans, thereby integrating multiple planning programmes.

Sponge city building is not the responsibility of a single government department, but rather a collaborative effort between many ministries. The programme has clearly delineated roles for each participating department and formed a distinct leadership group comprised of leaders from several participating departments. Municipal corporations and district governments in Lucknow coordinate the development of sponge cities. The Municipal Urban and Rural Department is in charge of the general development and marketing of the sponge city initiative. The Development Authority is responsible for implementing the sponge city idea in projects involving green space, whereas the Municipal Corporation is responsible for implementing the concept in water-related initiatives. Niti Ayog will be responsible for sponge city management oversight and project approval.

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