Chapter 16
Integrating Artificial Intelligence in Blue-Green Infrastructure: Enhancing Sustainability and Resilience

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ABSTRACT

This chapter explores the transformative role of Artificial Intelligence (AI) in enhancing the design, implementation, and management of Blue-Green Infrastructure

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(BGI), a sustainable urban planning approach that integrates natural and engineered systems to address environmental challenges. The convergence of AI with BGI offers unprecedented opportunities to improve urban resilience, optimize resource management, and mitigate the impacts of climate change. Through advanced data analytics, predictive modeling, and real-time monitoring, AI-driven solutions can enhance the efficiency and effectiveness of BGI projects. This chapter delves into the various AI applications in BGI, including smart water management, flood prediction and prevention, urban heat island mitigation, and biodiversity conservation. Case studies and examples from global cities illustrate how AI is being leveraged to create more adaptive, sustainable, and resilient urban environments. The chapter also discusses the challenges and ethical considerations associated with the integration of AI in BGI, emphasizing the need for interdisciplinary collaboration and responsible AI deployment to ensure equitable and long-term benefits.

INTRODUCTION

The rapid urbanization of the 21st century has brought about significant environmental challenges, including increased flooding, urban heat islands, water scarcity, and biodiversity loss. These challenges have necessitated a shift in urban planning approaches, moving from traditional, gray infrastructure—characterized by concrete, steel, and other man-made materials—to more sustainable and resilient solutions. One such approach is Blue-Green Infrastructure (BGI), which integrates natural and engineered systems to create multifunctional landscapes that address environmental issues while enhancing the quality of urban life. Blue-Green Infrastructure includes elements like parks, wetlands, green roofs, rain gardens, permeable pavements, and water bodies that work together to manage stormwater, reduce heat, improve air quality, and support biodiversity.

As cities continue to grow, the complexity of managing these interconnected systems increases. Traditional methods of planning, designing, and managing urban infrastructure often fall short in addressing the dynamic and interdependent nature of urban ecosystems. This is where Artificial Intelligence (AI) comes into play. AI, with its ability to process vast amounts of data, recognize patterns, and make predictions, offers powerful tools to enhance the effectiveness of Blue-Green Infrastructure. By integrating AI into BGI, urban planners, engineers, and environmental scientists can create smarter, more adaptive, and resilient cities that are better equipped to handle the challenges of the future.

Blue-Green Infrastructure is rooted in the idea of working with nature, rather than against it. Unlike traditional gray infrastructure, which often focuses on single-purpose solutions, BGI promotes the use of natural processes to deliver multiple