

Urban green infrastructure as a collaborative tool in architectural heritage preservation and valorisation

Natalija Ilić¹*

¹ University of Niš, Serbia. *stankovicnatalija1@gmail.com

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Abstract

This paper investigates the role of Urban Green Infrastructure (UGI) in the preservation and spatial enhancement of built heritage within cultural-historical settings. Using the Bubanj Memorial Park in Niš, Serbia, as an illustrative example, the research explores how ecological elements can be integrated into heritage conservation to support sustainable development, reinforce place identity, and revitalize neglected memorial landscapes. UGI is positioned as a collaborative and multidisciplinary tool that connects environmental and cultural values. Through conceptual design guidelines rooted in ecological planning and heritage interpretation, the study shows how green systems contribute to the transmission of collective memory and encourage public trust in the urban environment. The findings advocate for a dynamic approach to heritage, treating it as an active component of contemporary urban life. By bridging architecture, landscape, and memory, the paper highlights the potential of UGI to foster inclusiveness, community engagement, and long-term care for shared cultural assets.

Keywords: Architecture, Collaboration, Trust, Convergence, Urban Green Infrastructure, Heritage

Introduction

Modern cities face increasing challenges in preserving cultural-historical and architectural heritage, particularly in the context of rapid urbanization and changing land-use patterns. Culturally significant spaces, such as memorial parks, are often neglected in planning practice, lacking integrated strategies that would enable their valorisation and sustainable use. The degradation and loss of cultural-historical ensembles due to urban expansion and inadequate planning often result in spatial fragmentation, diminished integrity of architectural heritage, and the erosion of its authentic characteristics. In this context, the concept of Urban Green Infrastructure (UGI) is increasingly recognized as a key instrument for enhancing the quality of urban space and serves as a valuable tool for achieving resilient protection of cultural heritage (Brandful Cobbinah & Addaney, 2019). In line with global and European efforts towards sustainable development, a growing number of contemporary initiatives and projects address the issue of adequate preservation and rehabilitation of architectural heritage, particularly through approaches that integrate ecological, cultural, and energy-efficiency goals. The subject of this paper is the exploration of the potential of urban green infrastructure in the preservation, interpretation, and spatial valorisation of architectural heritage within cultural-historical ensembles, illustrated through a case study of the Bubanj Memorial Park in Niš. The main objective of the research is to highlight the possibilities for applying UGI elements in the preservation and spatial valorisation of cultural-historical ensembles, through the formulation of general conceptual guidelines.

Literature Review

Urban Green Infrastructure (UGI) refers to a network of natural and semi-natural elements within urban environments that support the preservation of ecological functions, improve quality of life, and contribute to the sustainable development of cities. Unlike traditional grey infrastructure, green infrastructure utilizes natural processes to

deliver services such as water filtration, flood control, air purification, and habitat creation (Benedict & McMahon, 2012). According to the European Environment Agency (EEA), in practice, green infrastructure is often realized as a form of "hybrid infrastructure", meaning a combination of green areas and engineered systems that support and integrate diverse ecosystem functions within urban settings (European Environment Agency, 2011). Its essential value lies in the fact that it functions not only as an aesthetic enhancement but also as an infrastructural system that contributes to microclimate regulation, air pollution reduction, stormwater management, and biodiversity conservation. In addition to ecological and health-related benefits, UGI holds significant cultural and social importance. It contributes to strengthening place identity, supporting shared historical consciousness, and enhancing the quality of public space by creating environments suitable for gathering, recreation, and education. Urban green spaces, with their diverse typological characteristics, are fundamental physical and functional components in the practical application of UGI. Urban green (and blue-green) spaces are highly varied and multifunctional, enhancing both the utilitarian and design potential of city spaces and contributing to their sustainability. Various typologies of urban green spaces exist in practice, and the GREEN SURGE project contributed to the understanding of these spaces by developing a typology comprising 44 elements organized into eight groups, linking them to scientific evidence on their ecosystem services (Cvejić et al., 2015).

The term built heritage today refers to everything constructed in the past that holds specific monumental or heritage value, which justifies the need for its protection and conservation (Nenadović, 1980). Built heritage includes immovable cultural properties of historical, artistic, architectural, urbanistic, or technical value, created through human activity across various historical periods. According to UNESCO (1972), built heritage comprises monuments, groups of buildings, and sites of outstanding universal value from the historical, artistic, or scientific point of view, or in terms of aesthetics, town planning, or landscape. The demolition of historic urban environments to make way for new constructions or to highlight monumental buildings for aesthetic

views dates back to the Renaissance, but reached its peak in the 19th century (Nenadović, 1980). When heritage sites become isolated or unreadable within the urban fabric, they lose their role as carriers of collective memory and local identity. This renders the heritage "invisible" in everyday life, thereby weakening its potential to contribute to quality of life through its educational, symbolic, and cultural functions. Unplanned construction, transport infrastructure, and disregard for the context in which heritage exists often result in fragmentation of cultural-historical ensembles. In response to these challenges, the UGI concept emerges as a promising framework for developing new models of preservation and interpretation of built heritage. In the context of heritage protection, UGI can serve multiple roles: As a physical buffer, shielding heritage spaces from the negative impacts of urban development; As a symbolic framework, reinforcing narratives and meanings linked to historical events and collective memory; As a tool for interpretation, where design and careful selection of vegetation aid in the reading and understanding of heritage sites.

Methodology

Methodologically, the paper applies descriptive analysis to examine the theoretical framework of urban green infrastructure and cultural-historical ensembles. A comparative-analytical method is used to analyse the relationship between the spatial and functional characteristics of the Bubanj Memorial Park and the principles of green infrastructure. Finally, the method of conceptual modelling is employed to formulate guidelines that could contribute to the improvement of similar spaces.

Results - Bubanj Memorial Park: Preservation Challenges and UGI-Based Interventions

Bubanj Forest Park represents a significant memorial monument of the City of Niš. It is located on an elevated terrain on the city's

southwestern periphery, covered with forest and centered around the “Three Fists” monument, built in remembrance of World War II victims (Fig. 1). The memorial complex was established in 1963, when three monumental concrete fists, a work by sculptor Ivan Sabolić, were erected to symbolize the resistance of men, women, and children. It spans approximately 42 hectares and includes forest areas, grasslands, walking trails, memorial structures, and supporting infrastructure. Bubanj is one of the richest green complexes in Niš in terms of vegetation diversity and also serves as a significant habitat for various animal species (Turistička organizacija grada Niša).



*Fig. 1 Location of Bubanj Forest Park in relation to the city of Niš, Serbia
(Source: Google Earth)*

In recent years, parts of the green belt around the central monument have been restored, while forest zones remain neglected. Park facilities, such as the stage, sanitation units, paths, and lighting, are poorly maintained, diminishing both functionality and symbolic value. Although the Revitalization and Green Infrastructure Improvement Program identified key goals – environmental protection, landscaping, and recreation, it lacked a comprehensive approach (Program revitalizacije i unapređenja zelene infrastrukture "Park šume Bubanj"). The program did not adequately address built heritage preservation or provide guidelines for the site's cultural, historical, and educational dimensions. As a result, implementation was partial, and crucial

aspects of memorial preservation and interpretation remain unresolved. Despite existing plans and initiatives, Bubanj Memorial Park still faces challenges in protecting both its built and landscape heritage.

Improving Bubanj Memorial Park requires identifying specific UGI elements that can support its preservation and valorization. UGI encompasses a wide range of ecologically based elements at different spatial scales, including structural components such as parks, urban forests, meadows, rivers, wetlands, green roofs and walls, and vegetated belts, as well as technical solutions like rain gardens, permeable paving, bioretention systems, and rainwater reservoirs (European Commission, 2013). Smart Green Infrastructure elements, such as environmental sensors, smart irrigation, and biodiversity monitoring, can further enhance management.

Given its scale, landscape diversity, biodiversity, and dual natural and cultural significance, Bubanj Memorial Park is an integral part of Niš's UGI network. While it already contributes to microclimate regulation, recreation, memorial identity, and vegetation protection, targeted upgrades to specific zones –trails, forest belts, lawns, access points, and the monument area, could strengthen its ecological performance and reinforce its cultural, educational, and social functions.

The provided analytical-illustrative map outlines the spatial organization of the memorial complex and identifies opportunities for enhancement through specific interventions and illustrative proposals (Fig. 2). The central zone around the "Three Fists" monument offers potential for the installation of natural-material seating (wood, stone), introduction of drought-resistant flora, and placement of educational panels and ambient lighting. The amphitheater in the southeastern area could incorporate natural canopies (green pergolas) and recycled-material urban furniture. For deteriorated paths, replacement with permeable paving is advised to enable water infiltration, along with bioretention areas alongside paths for stormwater control. The peripheral forest belt has potential for selective renewal to increase biodiversity. The concrete sports ground on the western side could be transformed into a multifunctional zone

with sports, recreational, and educational amenities enhanced with green elements. The memorial wall area in the northwest part of the park could benefit from improved access and lighting, along with a vegetative frame (e.g., native climbing plants) to emphasize the importance of the space.

In this way, the proposed interventions not only enhance the ambience and functionality of the area but primarily contribute to the preservation of the Bubanj Memorial Park as a site of cultural and historical heritage. By using natural and sustainable materials, respecting the ambient values, and maintaining the park's spatial organization, the authenticity and symbolic meaning of the space are preserved.



Fig. 2 Conceptual proposal for the enhancement of Bubanj Memorial Park through the application of UGI (Source: Author)

Discussion

Based on the analysis of the current state, potentials, and heritage values of the Bubanj Memorial Complex, conceptual guidelines for integrating Urban Green Infrastructure (UGI) elements are proposed to preserve the site's cultural-historical identity, strengthen its ecological functions, and improve user experience. Grounded in contemporary urbanism and sustainable planning principles, these

guidelines emphasize: 1. Preservation of memorial structure and visual legibility - UGI elements should align with the site's spatial organization and symbolic meaning, with minimal interventions that maintain authenticity and respect key visual axes; 2. Revitalization of natural components - Protect native species, restore degraded ecosystems, conserve biodiversity, and create microhabitats for wildlife; 3. Multifunctionality - Introduce green elements that combine ecological, aesthetic, educational, and social functions; 4. Context-appropriate materials and design - Use natural, local, and recycled materials in harmony with the existing landscape, with permeable surfaces for stormwater infiltration. 5. Participatory planning and management - Engage the local community and experts in heritage, landscape architecture, and ecology in all stages. 6. Education and awareness - Promote responsibility and a sense of belonging through workshops, surveys, and pilot projects.

Conclusion

Preserving built heritage in contemporary urban environments facing global challenges requires integrated approaches that unite cultural, ecological, and social dimensions. Memorial complexes like Bubanj Memorial Park, despite their cultural and symbolic significance, often remain on the margins of planning interest. This research shows that UGI offers an effective framework for preserving, interpreting, and enhancing cultural-historical sites, particularly in memorial contexts. The Bubanj Park case study confirms that such spaces, though protected, often suffer from fragmented strategies that neglect the balance between natural, cultural, and social aspects. The proposed improvements and conceptual guidelines demonstrate how UGI elements can integrate ecological and cultural goals while preserving authenticity. Ultimately, this approach positions Bubanj Memorial Park as a potential model for sustainable heritage management, promoting the harmonious coexistence of ecological, cultural, and spatial values in urban settings.

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Infrastructura verde urbană ca instrument colaborativ în conservarea și valorificarea patrimoniului arhitectural

(rezumat)

Acest articol investighează rolul Infrastructurii Verzi Urbane (UGI) în conservarea și valorificarea spațială a patrimoniului construit în contexte cultural-istorice. Utilizând Parcul Memorial Bubanj din Niș, Serbia, ca exemplu ilustrativ, cercetarea explorează modul în care elementele ecologice pot fi integrate în conservarea

patrimoniului pentru a susține dezvoltarea sustenabilă, a consolida identitatea locului și a revitaliza peisajele memoriale neglijate. UGI este poziționată ca un instrument colaborativ și multidisciplinar care conectează valorile ecologice și culturale. Prin ghiduri de design conceptual bazate pe planificare ecologică și interpretarea patrimoniului, studiul demonstrează cum sistemele verzi contribuie la transmiterea memoriei colective și încurajează încrederea publicului în mediul urban. Constatările pledează pentru o abordare dinamică a patrimoniului, tratându-l ca pe o componentă activă a vieții urbane contemporane. Prin conectarea arhitecturii, peisajului și memoriei, articolul evidențiază potențialul UGI de a promova incluziunea, implicarea comunității și grija pe termen lung pentru bunurile culturale comune.