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ENHANCING NATURE IN CITIES
frameworks and strategies for resilient and healthy urban environments



Lorenzo Diana, Simona Colajanni, Gaetano Sciuto, Francesco Sommese
editors

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Introduction

Lorenzo Diana, Simona Colajanni, Gaetano Sciuto, Francesco Sommesse

Editors

The international conference “Enhancing Nature in Cities” (ENC) stems from the extensive work carried out within the national research project “Greenwork: an interdisciplinary framework for urban health and urban resilience enhancement based on greening strategies on buildings and open spaces”, funded by the PNRR (National Recovery and Resilience Plan). The project’s main objective was the development of a comprehensive framework for defining and applying greening strategies in built-up urban environments, with the aim of ensuring their effectiveness across multiple spatial scales and varying local conditions.

Today’s cities face increasingly complex challenges that directly affect citizens’ well-being, public health, climate resilience, and the ecological quality of outdoor spaces. Critical issues such as air pollution, the intensification of urban heat islands, biodiversity loss, and rising natural and human-made risks call for strategic rethinking in urban planning, land-use policy, program development, and building design, prioritizing integrated, adaptive, and sustainable solutions.

Nature-based Solutions (NbS), recognized by numerous European and international initiatives and regulatory frameworks (e.g., the Green Deal, EU Biodiversity Strategies, the Urban Agenda for the EU, and the UN Sustainable Development Goals), offer a powerful and promising approach to re-establishing a practical, functional, and meaningful relationship between nature and urban environments. While mitigation of climate change has often fallen short of expectations, the potential of NbS is now increasingly acknowledged, especially as a key adaptation measure to climate-related stressors rather than a direct solution for emission reduction.

Nevertheless, despite the well-established benefits, the implementation of urban greening and NbS still encounters numerous obstacles. These include scientific knowledge gaps, operational difficulties, and fragmented policy frameworks. Particularly challenging is the integration of NbS into coherent systems that effectively address resilience to both anthropogenic and climatic pressures, support the regeneration of existing urban environments, and contribute meaningfully to the physical and psychological well-being of individuals and communities.

The aim of the ENC conference is to restore visibility and centrality to the issue of greenery and sustainability in the built environment. For decades, the academic community has recognized the fundamental importance of these themes to the survival, adaptability, and development of urban society. However, recent international geopolitical shifts and evolving global priorities are redirecting research funding and attention towards other sectors, like defense technologies and automated systems, often at the expense of sustainability.

Refocusing academic and institutional attention on the sustainability of cities and the role of nature in shaping urban life constitutes both a gesture of scientific responsibility and an act of political resilience. It represents a deliberate effort to reaffirm the enduring relevance of environmental and social well-being within research agendas.

The conference takes its first steps from the outcomes of the “Greenwork” project, which successfully brought together multiple disciplines to define a shared and adaptable framework for the implementation of green interventions, intended to operate effectively across different spatial scales and urban contexts.

Both the project and the scientific contents of the conference highlight a significant evolution: a shift from an interdisciplinary and multi-scalar approach toward a genuinely transdisciplinary and transcalar perspective.

Transdisciplinarity implies a fusion of varied forms of knowledge into a unified, deeply integrated perspective that goes beyond multidisciplinary (where multiple disciplines work in parallel) and interdisciplinary (where disciplines interact and influence one another). Transcalarity refers to the necessity of addressing urban sustainability across multiple spatial and governance levels (from the scale of the individual building to that of region) through coherent, context-sensitive strategies.

Urban greening in cities is, therefore, a vital tool for addressing a wide spectrum of urban challenges: from mitigating the effects of heat islands and improving stormwater management, to enhancing public health and fostering stronger forms of social cohesion. By bringing together scholars and professionals from different disciplinary backgrounds and spatial domains, this conference aims to deepen the collective understanding of green infrastructure as a pivotal component of sustainable urban futures.

The transcalarity and transdisciplinary nature of the conference is clearly demonstrated by the numerous topics and subtopics addressed which engage a wide range of actors, methodologies, and research perspectives. The sections into which the conference has been structured are: 1) resilience to urban risks, 2) urban microclimate and outdoor spaces, 3) interventions at the building level.

Within the broader discourse on urban resilience, the contributions delve into a variety of interconnected themes that explore the multifaceted role of NbS in addressing both natural and anthropogenic risks. Particular attention is given to multi-risk assessment tools aimed at enhancing cities’ adaptive capacities, alongside investigations into stormwater management systems and their integration with NbS. Both experimental and numerical approaches are presented to evaluate the feasibility and effectiveness of these solutions within complex urban environments. In parallel, several studies reflect on the potential of NbS to foster urban well-being and public health, highlighting their capacity to alleviate environmental anxiety and enhance overall quality of life. Moreover, the social dimension of green interventions emerges as a crucial aspect, with a focus on participatory planning, shared responsibility, and the cultivation of a collective sense of belonging through community engagement in the design and stewardship of green spaces. This exploration is further enriched by analyses of the economic and social repercussions of greening strategies, as well as by contributions examining statistical, agronomic, and biological factors vital for ecosystem protection.

When turning to the theme of urban microclimate and outdoor spaces, the discussion centers on the potential of NbS to mitigate urban heat island effects and to enhance outdoor thermal comfort. Contributions investigate how greening strategies can be effectively integrated into dense urban fabrics, and reflect on the economic and administrative frameworks necessary to support such interventions.

At the building scale, the dialogue shifts toward specific applications such as green roofs, living façades, and pocket gardens, considered not only for their aesthetic value but also for their impact on passive climate control and user well-being. The integration of greenery with energy-efficient strategies, especially in the context of historic buildings, is another area of interest, accompanied by reflections on the cost-effectiveness, management, and long-term maintenance of green infrastructure in architectural contexts.

It is within this broad landscape that the conference positions itself as a distinguished platform for dialogue and exchange, where researchers and practitioners from various disciplinary backgrounds are invited to engage in a shared reflection on effective strategies for regenerating urban spaces, strengthening the resilience of

environmental systems, and envisioning new paradigms of sustainable well-being. This moment of collective engagement aspires to initiate a more layered and multidimensional reflection on the transformative potential of NbS, not only as instruments of mitigation and adaptation, but also as powerful cultural and social drivers capable of reshaping the profound relationship between human communities, the environment, and the city.

Topic A
Resilience to urban risks

Inclusive paths for the experimentation of ecological solutions. Application of participatory strategies at the Unipa Campus

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Highlights

- Student-led workshops tested greening strategies for underused campus spaces
- Context-specific prototypes improved outdoor usability and thermal perception
- Participatory design for replicable, low-impact solutions for environments

Keywords

Architectural Engineering Workshop; Greening Solutions, Design for all, Greening Applications, Participatory Approaches



Workshop on applications of building strategies at Unipa Campus @Author2025

Introduction

The implementation of greening strategies within university environments has gained growing relevance in recent years, as part of a broader reflection on sustainable development, urban resilience, and environmental well-being [1]. Within the consolidated framework of Nature-Based Solutions (NBS), academic campuses are increasingly recognized as living laboratories where ecological interventions can contribute to climate adaptation, social inclusion, and educational innovation [2,3]. In particular, universities in Mediterranean contexts face pressing challenges due to recurrent heatwaves and high solar radiation, which compromise the usability of outdoor spaces and exacerbate thermal discomfort. In such settings, greenery can serve not only an aesthetic function but also act as a climate-responsive infrastructure capable of enhancing microclimatic performance, stimulating sustainable behaviors, and activating underutilized areas [4,5].

Despite this growing awareness, many campuses still present fragmented and inconsistent applications of green infrastructure, often disconnected from spatial functionality and environmental performance [1]. This condition is evident at the University of Palermo (Unipa), where the distribution of green systems is uneven and frequently uncoordinated with the actual use and accessibility of spaces. Several zones remain underused or completely abandoned, especially where vegetation is scarce or inappropriately integrated into the architectural and climatic context [2]. Among these neglected areas, the chapel courtyard emerges as a particularly emblematic case. Despite the architectural and symbolic value of the chapel itself, the surrounding open space is characterized by harsh microclimatic conditions, lack of shading and seating, and an overall absence of spatial quality [2]. These factors have contributed to its progressive abandonment and have prevented the area from serving as a meaningful public space within the campus fabric.

Objectives

This research seeks to explore the potential of greening strategies as a catalyst for reactivating neglected university spaces, focusing on the case of the campus chapel area at Unipa. The project is rooted in the hypothesis that the integration of vegetated systems and environmentally responsive design elements can significantly improve the usability, comfort, and social relevance of outdoor academic environments [3].

The main objectives of the study are to identify spatial and climatic criticalities within the campus, test the applicability of low-impact and reversible green design strategies, and engage students in a hands-on learning process that connects environmental awareness with design practice [4]. A participatory design methodology was adopted, involving a workshop with students from the UNIPA Campus aimed at recognizing the potential of underutilized green areas to be converted into spaces for socialization, collaboration, and the inclusion of vulnerable individuals. Furthermore, the study aims to offer a set of feasible, scalable, and context-sensitive interventions that may serve as a reference for broader applications across similar Mediterranean academic institutions.

Methodology

The methodological framework adopted in this research integrates analytical investigation, educational experimentation, and spatial design. It was developed as part of a workshop that engaged students from architecture and design programs, who acted simultaneously as researchers and designers in the transformation process.

The initial phase of the study was dedicated to identifying priority areas for intervention through a systematic campus survey. The choice of sites was guided by three complementary aspects: the presence of microclimatic discomfort due to excessive solar exposure and lack of vegetation, the recurrent observation of abandonment or limited use during daily student activities, and the reduced accessibility or absence of basic equipment for outdoor permanence. These conditions were verified through quantitative measurements, including surface and air temperature readings, solar exposure analysis, and wind pattern observations, combined with qualitative tools such as user surveys and direct spatial perception assessments [5].

Within this framework, the chapel courtyard was identified as a critical site because of its symbolic value, central position within the campus, and unfavorable environmental conditions. A detailed site analysis recorded surface materials, vegetation, shading potential, and access points, providing the basis for the design brief [6]. Students were then organized into four interdisciplinary teams and invited to develop greening strategies tailored to the courtyard's specific needs [7].

The workshop progressed through successive cycles of analysis, design exploration, and critical review. Rather than focusing on predefined solutions, the process encouraged the open development of low-tech, reversible, and climate-sensitive proposals. Particular attention was given to strategies integrating passive shading

devices, vegetated systems, modular seating, and multifunctional furniture designed to support diverse activities throughout the day and across seasons.

To assess feasibility, students developed conceptual models and prototypes using analog and digital tools. The proposals were validated through peer review sessions, tutor evaluations, and comparisons with benchmark studies on small-scale greening interventions in Mediterranean contexts [4,5]. Without full-scale monitoring, expected microclimatic benefits were inferred by aligning the proposed solutions with performance data documented in the literature.

This methodological pathway combined research and design experimentation while establishing a replicable learning model in which students engaged with real-world challenges. By linking quantitative analysis, participatory design, and qualitative validation, the approach showed the potential to generate scalable, low-impact, and context-sensitive greening strategies applicable to other academic environments.

Results

The outcomes of the workshop highlighted both opportunities and challenges in integrating greening strategies in university settings. Each of the four student teams proposed distinct intervention strategies, reflecting different priorities and interpretations of the site's potential. Despite their differences, all proposals shared a commitment to climatic adaptability, spatial inclusivity, and material sustainability [8].

Among the most recurrent design elements were modular seating systems, lightweight shading structures, and vegetated installations based on native or low-maintenance plant species. The prototypes emphasized reversibility and scalability, suggesting that even minimal interventions—when carefully designed—can significantly improve environmental comfort and spatial perception.

To support design proposals with preliminary evidence, microclimatic measurements were carried out in the chapel courtyard using the HD32.3TC data logger. Data collected during summer peak conditions revealed surface temperatures exceeding 46 °C in fully exposed areas, compared to 33 °C in shaded zones, highlighting the critical role of shading in reducing thermal stress. Air temperature measurements confirmed differences of up to 3–4 °C between vegetated and non-vegetated points. Similarly, relative humidity increased slightly (by 5–7%) near vegetation, while globe thermometer readings indicated radiant heat peaks above comfort thresholds during midday hours [5]. These results provided an empirical basis for estimating the potential benefits of the proposed greening interventions, particularly vegetated shading systems, expected to reduce radiant loads and extend courtyard usability.

From an educational perspective, the workshop fostered strong student engagement, enabling participants to experience the full process from analysis and data collection to ideation and prototyping. Their proposals were not only academic exercises but also tangible contributions to the campus transformation debate. The participatory nature of the workshop also prompted discussion on the role of academic communities in shaping their environments and the importance of interdisciplinary collaboration in addressing climate-related challenges.

Despite the richness of the outcomes, some obstacles may hinder real-life implementation, including bureaucratic inertia, limited funding, and the absence of institutional mechanisms for integrating student-driven projects into campus planning. Nevertheless, the results were formally presented to university stakeholders, laying the groundwork for potential adoption and creating a knowledge base for future greening initiatives [9].

Discussion

The experience gained through this research confirms that small-scale, user-centered greening interventions can effectively regenerate neglected academic spaces, particularly in contexts where heat stress and solar exposure reduce outdoor usability. Integrating green strategies improves microclimatic conditions, redefines spatial hierarchies, and fosters community ownership.

The chapel courtyard, once perceived as residual and inhospitable, was reframed as a potential hub of social interaction, environmental regeneration, and symbolic continuity. This transformation was achieved not through costly or complex technologies but through the sensitive application of climate adaptation principles, material compatibility, and spatial empathy. Such an approach is especially relevant in Mediterranean settings, where heritage, climate, and limited resources intersect.

The project also underscores the educational value of embedding real-world challenges into academic curricula. By engaging with concrete environmental problems, students strengthened critical thinking,

collaboration, and design skills, while gaining greater awareness of the responsibilities and opportunities inherent in spatial practice.

Conclusion

This study demonstrates that the regeneration of university spaces through greening strategies is both urgent and feasible, provided that interventions are context-sensitive, low-impact, and inclusive. The case of the University of Palermo shows how even marginal areas can become valuable assets through targeted and participatory processes.

The methodological approach outlined here can serve as a replicable model for Mediterranean campuses facing climatic discomfort and spatial degradation. By linking analytical research, design experimentation, and education, the initiative offers a holistic framework for more resilient, livable, and community-driven academic environments.

Nevertheless, several barriers may hinder implementation, including bureaucratic inertia, limited resources, and the lack of governance mechanisms for integrating student-led projects into institutional planning. Addressing these challenges requires stronger institutional commitment and long-term strategies that align ecological objectives with administrative and community priorities.

Although preliminary, the results suggest a clear direction: embedding greening pathways into university development plans, enhancing student participation in spatial governance, and cultivating a long-term vision of environmental and social sustainability [10]. In a time marked by environmental urgency and spatial inequality, such actions contribute to the broader goal of reimagining how we inhabit and care for shared environments.

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This volume collect the proceedings of the ENC Enhancing Nature in Cities conference, organized within the framework of the PRIN PNRR GREENWORK research project “An interdisciplinary framework for urban health and urban resilience enhancement based on greening strategies on buildings and open spaces”.

The collected contributions are structured around three main thematic areas: resilience to urban risks, urban microclimate and open spaces, and interventions at the building scale, offering an interdisciplinary and integrated perspective on the challenges and opportunities of the ecological transition in urban contexts.