GLOBAL SUSTAINABILITY AND DEVELOPMENT CONGRESS

OCTOBER 15-16, 2025 / KAYSERI, TÜRKİYE

FULL TEXT BOOK

EDITORS
Prof. Dr. Oktay ÖZKAN
Assoc. Prof. Dr. Şükrü Taner AZGIN

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GLOBAL SUSTAINABILITY AND DEVELOPMENT CONGRESS

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OPENING CEREMONY

Erciyes University Faculty of Engineering
Date: 15.10.2025

09:30-10:30	Registration
10:30-11:00	Opening Speeches
	Assoc. Prof. Dr. Şükrü Taner AZGIN Sustainability Coordinator of Erciyes University HEAD OF ORGANIZING BOARD
	Dr. Atabek MOVLYANOV General Coordinator of IKSAD Institute CONGRESS COORDINATOR
	Prof. Dr. Fatih ALTUN Rector of Erciyes University HONORARY HEAD OF CONGRESS
11:00-11:40	**Yunus Emre ŞEKER** Secretary General of the Central Anatolia Development Agency INVITED SPEAKER
11:40-11:50	Plaque Ceremony
12:00-13:30	Lunch

Participants Country: Albania, Algeria, Argentina, Australia, Azerbaijan, Bangladesh, Bulgaria, China, Czechia, Egypt, Georgia, Hong Kong, Hungary, India, Indonesia, Iran, Kazakhstan, Kosovo, Lithuania, Malaysia, Morocco, Niger, Nigeria, Oman, Pakistan, Portugal, Romania, Russia, Saudi Arabia, Tunisia, Türkiye, TRNC, UAE, UK, Ukraine, USA, Vietnam

15.10.2025 / HALL-5 / SESSION-3 / TSI Time-15^{00}:17^{00}

ZOOM ID: 860 5266 6988 / PASSCODE: 123456

HEAD OF SESSION: Assoc. Prof. Dr. Tolga ERKAN

Authors	Affiliation	Presentation title
Shafiul Muznobin	Pabna University of Science and Technology (PUST), Bangladesh	APPLICATION OF SUSTAINABLE BUILDING MATERIALS FOR GREEN CONSTRUCTION IN BANGLADESH
Assist. Prof. Payam Tarighi **Ali Akbary**	Ahlul Bayt International University, Iran	REVOLUTIONIZING CONSTRUCTION: EMERGING MATERIALS AND THEIR ROLE IN SUSTAINABLE DEVELOPMENT
Mehreen Ashfaq **Assist. Prof. Farhana Naz** **Assist. Prof. Maryam Usman**	Interior Designer, Lahore Pakistan Lahore College for Women University, Pakistan	FROM WASTE TO VALUE: CONCEPTUALIZING A FASHION HUB FOR SUSTAINABLE FUTURES
Akhi Akther **Saikot Hasan**	University of Rajshahi, Bangladesh Bangladesh Agricultural University, Bangladesh	SUSTAINABLE DEVELOPMENT THROUGH CULTURAL HERITAGE: A LITERATURE REVIEW OF THE NABANNA FESTIVAL IN RURAL BANGLADESH
Aref Nouri **Prof. Dr. Mehrdad Karimimoshaver**	Bu-Ali Sina University, Iran	THE EVOLUTION OF RESIDENTIAL ARCHITECTURE: TOWARDS SUSTAINABLE AND BIOPHILIC DESIGN IN THE POST-PANDEMIC ERA
Lect. Pooja Shukla	Hong Kong Metropolitan University, Hong Kong	CARBON NEUTRALITY TARGETS AND FIDUCIARY DUTIES IN HONG KONG
Assoc. Prof. Dr. Tolga ERKAN	OSTIM Technical University, Türkiye	IMPLEMENTING BIODIVERSITY IN URBAN PROJECTS
Assoc. Prof. Dr. Tolga ERKAN	OSTIM Technical University, Türkiye	SPATIAL AND TEMPORAL PERSPECTIVES ON URBAN BIODIVERSITY

IMPLEMENTING BIODIVERSITY IN URBAN PROJECTS

Doç. Dr. Tolga ERKAN

OSTIM Technical University, Faculty of Architecture and Design, ORCID NO: 0000-0002-7578-2065

ABSTRACT

Urban areas face growing challenges due to rapid urbanization, climate change, and ecological degradation. This study examines strategies for implementing biodiversity in urban projects, emphasizing the role of green spaces in fostering ecological resilience and improving quality of life. Through a review of case studies and scholarly literature, the research explores the planning, design, and management of diverse urban green infrastructures, including public parks, urban and peri-urban forests, and fragmented green spaces. These spaces are analyzed not only as ecological assets but also as vital components of social well-being and climate adaptation. Key findings highlight multiple dimensions of urban biodiversity. Urban and peri-urban agriculture can strengthen food security while enhancing community cohesion. Linear or localized green spaces, such as roadside vegetation and transport corridors, contribute to connectivity between fragmented ecosystems. The study also addresses the critical relationship between biodiversity and urban water systems, examining rivers, ponds, wetlands, and their roles in flood risk management and ecological resilience, particularly in coastal cities. Furthermore, the integration of biodiversity into the built environment is explored through bioclimatic architecture, green roofs, walls, and facades, which support urban cooling and habitat creation. Pollution and waste management emerge as crucial factors for biodiversity protection. Strategies for landfill rehabilitation and post-landfill biodiversity demonstrate pathways to restore degraded urban sites. The study concludes by emphasizing biodiversity mainstreaming in all phases of urban planning, ensuring that ecological considerations are embedded in decision-making to create sustainable, resilient, and livable cities.

Keywords: Urban biodiversity, green infrastructure, ecological resilience, urban planning, sustainable cities.

Introduction

Urbanization, as an inevitable consequence of economic development and population growth, exerts mounting pressure on ecological systems, leading to biodiversity loss, environmental degradation, and intensified climate-related risks. In response to the rapid expansion of urban areas, the integration of biodiversity into urban planning has emerged as a critical strategy for promoting ecological resilience and advancing sustainable development. Once perceived predominantly as artificial constructs, urban ecosystems are now recognized as dynamic, living environments capable of supporting multiple forms of life when appropriately designed, managed, and connected. Green this framework, the implementation of green infrastructure, including urban parks, forests, agricultural zones, and fragmented ecological corridors, assumes a central role in harmonizing urban development with natural processes.

This study examines the multifaceted dimensions of biodiversity integration within urban environments, highlighting how the deliberate design, ecological management, and restoration of green spaces enhance ecosystem functionality while improving overall urban livability. Public parks and urban forests, for instance, deliver essential ecosystem services such as microclimate regulation, air quality improvement, water cycle management, carbon sequestration, and habitat provision for diverse species (Bolund & Hunhammar, 1999: 293-295). Beyond ecological functions, these spaces foster cultural identity, recreational engagement, and aesthetic appreciation, thereby contributing to psychological well-being and social cohesion (Goddard et al., 2010: 91, 92). In parallel, fragmented green infrastructures—such as rain gardens, bioswales, hedgerows, and green corridors—establish ecological connectivity within fragmented urban matrices, facilitating species movement, enhancing stormwater absorption, protecting soil integrity, and mitigating urban heat island effects.

Furthermore, urban and peri-urban agriculture has emerged as a transformative domain of ecological, social, and economic innovation, particularly within rapidly growing cities in developing regions (Elmqvist et al., 2015: 101, 102). By coupling food production with biodiversity enhancement, these systems strengthen food security, restore soil fertility, and encourage community participation grounded in ecological literacy and traditional practices. Agroecology, permaculture, and regenerative farming principles allow cities to reconfigure neglected or degraded areas into productive, biodiverse, and climate-resilient landscapes, reinforcing functional human–nature interactions.

Drawing upon insights from global case studies and institutional frameworks provided by organizations such as Agence Française de Développement (AFD) and the International Finance Corporation (IFC), this study underscores the imperative of embedding biodiversity considerations throughout all stages of urban planning and governance (Auvray & Poyer, 2021: 3). From policy formulation to spatial design and landscape stewardship, biodiversity must be institutionalized as a foundational principle guiding sustainable urban transformation. Ultimately, the study asserts that biodiversity is not a supplemental amenity of urban life but a fundamental prerequisite for building cities that are ecologically robust, socially inclusive, and resilient in the face of accelerating climate change.

Developing urban green spaces

Ecological projects aimed at introducing, enhancing, or managing vegetated public and private spaces are increasingly being implemented across diverse geographical and climatic contexts. These initiatives encompass a wide spectrum of interventions, ranging from urban parks and community gardens to bioswales, rooftop vegetation, and peri-urban agroecological systems, and are shaped by the biophysical, socio-cultural, and regulatory specificities of each territory (Beninde et al., 2015: 581, 582).

The management strategies adopted for such green infrastructures vary significantly depending on their designated functions, expected performance, and socio-ecological objectives. In particular, the intensity and typology of ecological management practices are influenced by three interrelated dimensions: (1) the requirements associated with residents' patterns of use and public accessibility; (2) the ecosystem services expected from these spaces such as thermal regulation, stormwater retention, carbon sequestration, soil stabilization, aesthetic and cultural enrichment; and (3) the targeted level of biodiversity reception, including the promotion of species richness, ecological connectivity, and habitat complexity (Alberti, 2005: 168-170).

Highly frequented recreational spaces may require more structured and maintenance-intensive interventions to ensure user safety, aesthetic quality, and social acceptability, whereas areas intended primarily for habitat conservation or ecological restoration may prioritize minimal intervention, natural succession, and species diversification. In contrast, multifunctional green spaces, designed to reconcile ecological and social functions, often adopt adaptive and hybrid management regimes that balance human use with long-term ecological performance (Netusil et al., 2014: 15).

Consequently, the governance of vegetated spaces requires a context-specific, function-oriented, and ecologically informed approach that aligns site management practices with broader sustainability objectives, biodiversity strategies, and territorial planning frameworks. Within this paradigm, green infrastructures are not merely ornamental additions to urban fabric but are strategic ecological assets that contribute to environmental resilience, social well-being, and landscape connectivity in the face of ongoing urbanization and climate change.

Public parks

Public parks represent structured urban green spaces intentionally designed to support leisure, recreation, and social interaction within accessible and environmentally regulated settings (Peters et al., 2010, 94). Characterized by a combination of open grassy areas, wooded zones, ornamental plantings, and constructed natural features such as ponds, watercourses, or fountains, these landscapes often integrate a diverse palette of vegetation, including turfgrass, trees, flowering species, and ornamental shrubs. To ensure their usability and inclusiveness, public parks are equipped with pedestrian pathways, benches, lighting systems, and other forms of urban furniture, facilitating safe and equitable access—frequently within walking or cycling distance for urban residents.

Open areas within these parks serve as flexible spatial typologies that accommodate a range of recreational, cultural, and social activities while contributing to the aesthetic and ecological identity of the park. The ecological management of these spaces is commonly guided by a differentiated maintenance regime, wherein mowing frequency, trimming intensity, and seasonal interventions are strategically adapted to spatial function, visitor density, and ecological objectives (Chiesura, 2004: 130, 131). Through this adaptive stewardship, recreational zones are preserved for high-frequency use, while designated ecological areas are allowed to develop structurally and biologically over time.

Such a management approach supports the progressive coexistence of anthropocentric and ecological functions, enabling urban parks to evolve as multifunctional landscapes that simultaneously enhance human well-being, strengthen urban biodiversity, and contribute to long-term environmental sustainability (Peters et al., 2010: 93-96). Ultimately, well-managed public parks function not only as recreational assets but also as vital components of urban green infrastructure, reinforcing ecological resilience and promoting socio-environmental cohesion within urban settings.

In accordance with its Corporate Social Responsibility (CSR) Plan, AFD explicitly excludes from appraisal and financing any projects that generate a net loss of biodiversity within areas classified as critical habitats. These critical habitats are defined as territories exhibiting exceptionally high biodiversity value, including regions that are essential for endemic or geographically restricted species, as well as key sites that support the survival and reproductive cycles of migratory species. They further encompass habitats that host substantial populations of congregatory species, landscapes characterized by unique species assemblages or significant evolutionary processes, and ecosystems that perform crucial ecological functions such as water regulation, soil stabilization, and carbon storage. Additionally, territories where biodiversity holds pronounced social, cultural, or economic significance for local communities—alongside primary forests and other high conservation value forest ecosystems—are recognized under this framework as critical zones warranting strict protection (Auvray & Poyer, 2021: 56).

Potential ecosystem services provided by urban parks encompass a wide range of environmental, social, and health benefits (Konijnendijk et al., 2013: 8, 14, 17, 20, 24, 31, 35). Thermal regulation is one of the most significant, as parks can cool the surrounding atmosphere by 1 to 3°C compared to urban blocks; in subtropical cities such as Mexico City, minimum temperatures within parks are observed to be 3 to 4°C lower than in adjacent urban areas. Water management is another essential service, with studies in Beijing showing that parks contribute to a 15–20% reduction in leakage rates, translating into annual savings of approximately €1.5 million. Through air purification, vegetation absorbs gaseous pollutants via stomata, resulting in a 35% reduction in fine particles, a 27% reduction in sulfur dioxide (SO_2), and a 21% reduction in nitrogen dioxide (NO_2) concentrations at ground level. As a base for biodiversity, parks serve as critical habitats where the number of species is proportional to the park's size, with high plant diversity and special importance for butterflies in tropical regions. Regarding public health, green spaces promote physical activity for all age groups, reducing obesity risks and extending life expectancy by up to eight years for elderly individuals living near parks. Moreover, access to green environments is linked to decreased prevalence of coronary heart disease (by 21%), anxiety disorders (by 31%), and diabetes (by 20%), particularly in areas where green space coverage increases from 10% to 90%. In terms of carbon storage, vegetation in urban parks sequesters considerable amounts of CO_2 between 9.10 and 9.79 kg CO_2 eq per year on average (based on data from Florence between 1985 and 2004), while in arid environments like Phoenix, USA, urban parks sequester around 3,630 tons of CO_2 annually, valued at approximately $283,000 and representing total storage exceeding $4.5 million. Finally, aesthetic and cultural values enhance the appeal of parks, as their natural beauty attracts visitors whose expectations vary across cultural contexts—ranging from appreciation of wild and contemplative landscapes to enjoyment of structured, social, or sport-oriented environments (Auvray & Poyer, 2021: 58).

Aligned with its broader sustainability commitments, AFD also prohibits the financing of projects involving the production, use, or promotion of pesticides and herbicides known to pose significant risks to ecological integrity and human health. In parallel, the International Finance Corporation, a member institution of the World Bank Group, has established a structured set of environmental and social performance standards, often operationalized through a reference matrix or exclusion diagram—to delineate categories of activities that are ineligible for financing. These standards serve as a regulatory benchmark for development institutions that adhere to IFC guidelines, ensuring that funded projects comply with internationally recognized principles of biodiversity conservation, environmental stewardship, and social responsibility (Auvray & Poyer, 2021: p. 116).

Urban and Peri urban forests

Urban woodlands, whether newly planted, remnants of natural ecosystems, or large forests within city limits, serve vital ecological roles by providing habitats that support full species life cycles. Their integration into urban environments necessitates strategic planning to balance ecological, recreational, and cultural functions. The concept of urban forest emerged in the late 20th century to describe forested areas within cities, while peri-urban forests refer to wooded zones at urban fringes. Unlike conventional recreational parks, urban forests prioritize ecological naturality, often featuring limited human intervention. These forests may be conserved ancient ecosystems or afforested landscapes that have been absorbed into expanding urban areas.

Urban forests deliver a broad spectrum of ecosystem services that enhance environmental quality, public health, and urban resilience. They contribute to thermal regulation by cooling microclimates, improving stormwater management through species-specific rainfall retention, and support air purification by removing pollutants. Carbon sequestration varies, while noise reduction for wider forest strips (Blanusa et al., 2019: 11, 12). Urban forests also function as biodiversity reservoirs, supporting up to 215 plant species, nearly half of which may be native, and enhancing ecological richness when deadwood is present. Additionally, they promote physical and psychological well-being by reducing stress and accelerating patient recovery in healthcare settings. Socially, they act as communal spaces that foster recreation and cohesion, with their recreational value in the world.

Other green spaces for use

Cemeteries exhibit ecological structures comparable to those of public parks but are generally subjected to lower levels of anthropogenic pressure due to reduced visitation and minimal maintenance requirements. Their biodiversity potential is heightened by the heterogeneity of microhabitats, particularly those formed by irregular spatial architectures, stone structures, and crevices that provide niches for various species (Löki et al., 2019). In contrast, sports fields typically offer limited ecological value due to their intensive management and uniform vegetation cover, which restrict opportunities for flora and fauna development. Nevertheless, the application of ecological management practices, particularly in peripheral areas such as hedgerows, buffer grass strips, and uncultivated margins, can enhance their function as transitional habitats and ecological corridors within the urban matrix. Similarly, private gardens constitute a critical component of urban biodiversity networks, especially in low-density cities where they occupy a substantial proportion of land. However, their ecological performance is strongly influenced by human-driven factors such as the socio-economic characteristics of owners, landscaping preferences, and individual perceptions of nature and green space management.

Urban and Peri urban agriculture

Urban and peri-urban agriculture, which encompasses activities such as arboriculture, horticulture, market gardening, and small-scale livestock farming, plays a crucial role in the socio-economic and ecological dynamics of many developing countries, particularly across the African continent. In the context of rapid urbanization, its strategic integration into urban systems offers significant opportunities for strengthening food security, both in qualitative and quantitative terms, promoting land reconversion, and preserving soil integrity. Beyond its productive functions, urban agriculture contributes to the establishment of ecological corridors, supports the rehabilitation of degraded or abandoned land, and acts as a spatial buffer between residential areas and natural environments (Auvray & Poyer, 2021: 66).

Sustainable agricultural paradigms such as agroecology and permaculture, urban and peri-urban farming systems can generate substantial ecosystem services, including biodiversity enhancement, soil regeneration, microclimate regulation, and carbon sequestration. Moreover, these practices carry important social, political, and cultural dimensions, fostering community engagement, strengthening local economies, and preserving traditional ecological knowledge (Wezel et al., 2009: 503-505). Within this framework, regenerative agriculture, focused on restoring the functional capacity of soils through biodiversity stimulation and closed-loop nutrient cycling, emerges as a particularly promising model, offering synergistic benefits for ecological resilience, agricultural productivity, and long-term food sovereignty.

Fragmented green spaces

Fragmented green infrastructures such as rain gardens, swales, and hedgerows, function as both bioretention systems and ecological connectors within urban landscapes. Rain gardens are shallow, vegetated depressions designed to capture and infiltrate runoff from impermeable surfaces such as rooftops and paved areas, thereby contributing to stormwater regulation and mitigating flood risks (Davis et al., 2009, 110-112). Swales consist of gently sloped channels that direct stormwater toward bioretention zones while reducing flow velocity and enhancing natural filtration processes (Fletcher et al., 2015: 525-527). Hedgerows serve as linear ecological corridors that facilitate species dispersal and habitat connectivity, supporting the establishment of beneficial organisms including pollinators, predatory species, parasitoids, and decomposers. Collectively, these fragmented green elements play a critical role in both hydrological management and the enhancement of urban biodiversity.

Conclusion

The growing complexity of urban ecosystems calls for a holistic and integrated approach to biodiversity management within the built environment. As demonstrated throughout this study, urban green infrastructure ranging from public parks and urban forests to fragmented green spaces and urban agriculture—represent vital components of ecological resilience and human well-being. Each type of green space contributes uniquely to the urban fabric: parks regulate temperature and improve air quality; forests enhance carbon sequestration and provide habitats; rain gardens, swales, and hedgerows ensure water management and ecological connectivity; and urban agriculture strengthens food security while restoring soil health and reinforcing social cohesion. Together, these systems form a dynamic network of life that mitigates the impacts of climate change, reduces environmental risks, and enhances the livability of cities.

The case studies and evidence discussed underscore that biodiversity cannot be treated as a secondary consideration in urban planning—it must instead serve as a structural principle guiding every stage of urban development. Institutional frameworks, such as those established by AFD and IFC, exemplify the growing global recognition of biodiversity protection as a prerequisite for sustainable investment and ethical governance. The ecological, social, and economic benefits of green infrastructures reveal that investing in nature-based solutions yields long-term returns that far exceed conventional urban expansion models focused solely on built density and infrastructure efficiency.

In conclusion, fostering urban biodiversity requires a paradigm shift toward ecological urbanism, where planning, design, and policy operate synergistically to regenerate living systems rather than deplete them. The cities of the future must not only accommodate human populations but also sustain the intricate web of life upon which urban survival depends. By mainstreaming biodiversity into every aspect of urban policy and design—from climate adaptation and water management to cultural identity and public health—cities can evolve into regenerative environments that harmonize human activity with the principles of nature. Such an integrated vision will be essential to building sustainable, inclusive, and resilient urban landscapes for generations to come.

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