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20–22 May 2026 | Online

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The 1st International Online Conference on Urban Sciences

20–22 May 2026 | Online



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Welcome from the Chairs

We are thrilled to extend a warm welcome to you for the upcoming **1st International Online Conference on Urban Sciences (IOCUS 2026)**, proudly sponsored by the MDPI open access journal [Urban Science](#) (ISSN 2413-8851; IF: 2.9).

This conference offers a platform for scholars, researchers, and experts in the field of urban science to come together, exchange ideas, and showcase cutting-edge research. The conference will cover a wide range of topics in urban science, including, but not limited to, the following:

- S1. Urban Planning and Design;
- S2. Urban Environments and Sustainability;
- S3. Urban Economies and Resource Management;
- S4. Urban Mobility and Transportation;
- S5. Urban Resilience and Adaptation;
- S6. Urbanization and Social Development.

The event will take place virtually on [Sciforum.net](#), a platform developed and sponsored by MDPI to organize and provide technical support for electronic conferences. The virtual format offers the distinct advantage of eliminating the need for travel and its associated expenses, allowing you to engage in quick and direct exchanges regarding the latest research findings and innovative ideas.

We would like to express our sincere gratitude for your unwavering support and participation! Thank you for joining us on this journey of discovery and innovation in urban science.



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urban science

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Urban Science (ISSN 2413-8851) is an international, scientific, peer-reviewed, open access journal that provides an advanced forum for the exchange of ideas, methods, and information concerning life in urban areas. It publishes high-quality original articles, reviews, research notes, short communications, etc.

The primary aim of this journal is to encourage scientists to publish their theoretical and empirical research relating to urban development, planning, expansion, living conditions and well-being, and sustainability. Therefore, the journal has no restrictions on the length of manuscripts, provided that the text is concise and comprehensive. Full experimental details must be provided in order for the results to be reproduced.

Impact Factor: 2.9 (2024); **5-Year Impact Factor:** 2.7 (2024)

Session Chairs



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**Prof. Dr. Eusébio Z. E.
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Prof. Dr. Peter Newman

Curtin University Sustainability
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Prof. Dr. Bernhard Müller
School of Architecture and
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Keynote Speaker



Prof. Dr. Qihao Weng

Department of Land Surveying
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Invited Speakers



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Prof. Dr. Salvatore Antonio Biancardo

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Prof. Dr. Umberto Berardi

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Program Overview

	20 May	21 May	22 May
Morning	Session 1. Urban Planning and Design	Session 5. Urban Resilience and Adaptation	Session 2. Urban Environments and Sustainability
Afternoon	Session 4. Urban Mobility and Transportation	Session 6. Urbanization and Social Development	Session 2. Urban Environments and Sustainability Session 3. Urban Economies and Resource Management

IOCUS 2026 Program

20 May 2026 (Wednesday)

S1. Urban Planning and Design

Time: 9:00 (CEST, Basel)

Time (CEST)	Speaker	Title
<i>Opening Ceremony</i>		
9:00–09:15	<i>Prof. Dr. Francesco Aletta Prof. Dr. Jianming Cai Dr. Jieling Xiao Conference Chairs</i>	<i>Opening Ceremony</i>
<i>S1. Urban Planning and Design</i>		
09:15–09:25	Prof. Dr. Bernhard Müller Session Chair	Welcome from the Session Chair
09:25–09:45	Prof. Dr. Xuan Liu Invited Speaker	Transfer of Reclaimed Construction Land Quota: Restructuring Urban-Rural Link in China
09:45–10:05	Dr. Yan Zhang Invited Speaker	Urban Representation Learning and Human Mobility Research
10:05–10:20	Evgenia Tousi Selected speaker	Architectural Heritage and the Formation of a Layered Cityscape. The case of the Asia Minor Refugee settlements in Attica, Greece
10:20–10:35	Haneen Ahmad Selected speaker	Evaluating Safety and Inclusivity in Park Design Through Women's Safety Priorities Index (WSPI)
10:35–10:50	Jeba Muniat Selected speaker	Reclaiming Fragmented Urbanism in Dhaka, Bangladesh: A Data-Driven Evaluation of Infrastructural Voids and Strategic Pathways for Redesign
10:50–11:05	Anubhav Kumbhre Selected speaker	Assessing Visual Connectivity at Property Crime Hotspots in Nashik City
11:05–11:20	Altangerel Suvd-Ochir Selected speaker	A Study on Public Open Spaces in the Ger Districts of Ulaanbaatar city

S4. Urban Mobility and Transportation

Time: 14:00 (CEST, Basel)

Time (CEST)	Speaker	Title
14:00–14:10	Prof. Dr. Sergio Nesmachnow Prof. Dr. Vanessa de Almeida Guimarães Session Chairs	Welcome from the Session Chairs
14:10–14:30	Prof. Dr. Salvatore Antonio Biancardo Invited speaker	Digital Twins and BIM for Smart Transportation Infrastructure Management
14:30–14:50	Prof. Dr. Antônio Néilson Rodrigues da Silva Invited speaker	The Challenges of Combining Resilience and Sustainability in Urban Mobility
14:50–15:05	Madhuni Malsha Manohari Selected speaker	A Spatial Multi-Criteria Decision Analysis Framework for Strategic Prioritisation of Shared Pathway Infrastructure to Enhance Community Connectivity in Coastal Cities: A Case Study in Tauranga, New Zealand
15:05–15:20	Bayu Maulana Selected speaker	The Geometry of Delay: Assessing Route Tortuosity and Systemic Inefficiency in Jakarta's BRT Network
15:20–15:35	James Williams Selected speaker	Multi-Resolution H3 Walkability Surfaces: A Scalable Framework for Cross-City Pedestrian Environment Assessment
15:35–15:50	Diego Gabriel Rossit Selected speaker	Bridging Data Gaps for Smarter Decisions: Urban Microsimulation as a Strategic Tool
15:50–16:05	Hadjira Sakhri Selected speaker	Evaluation of Energy Harvesting from Pedestrian Movement Using Piezoelectric Flooring in Urban Mobility

		Infrastructure: A Case Study of “Les Fusilles” Metro Station, Algeria
16:05–16:20	Mariela Taboada Aguilar Selected speaker	Cycling Is Not the Same for Everyone: Gender Inequality in the Cycling Mobility of PUCP Students
16:20–16:35	Keerthana R Selected speaker	Equitable Transport Resilience to Urban Flooding

21 May 2026 (Thursday)

S5. Urban Resilience and Adaptation

Time: 9:00 (CEST, Basel)

Time (CEST)	Speaker	Title
09:00–09:10	Prof. Dr. Gang Xu Session Chair	Welcome from the Session Chair
09:10–09:30	Prof. Dr. Walaa Salah Ismaeel Invited Speaker	Spatially Enabled Environmental Impact Assessment Using AI and GIS
09:30–09:45	Xiaohang Liang Selected speaker	Construction of community resilience dynamic monitoring and real-time evaluation model framework based on multi-source data fusion
09:45–10:00	Francesco Sommesse Selected speaker	Towards Climate-Resilient Urban Neighbourhoods: Evaluating Green Infrastructure Strategies through Environmental Simulations
10:00–10:15	Pablo Cozano-Pérez Selected speaker	Microclimatic Variability and Thermal Discomfort during a Terral Event: The Role of Vegetation and Urban Form in Málaga, Spain
10:15–10:30	Adamantia Stamou Selected speaker	Structural Health Monitoring and Earthquake/Climate Proofing by means of AI Sensor Fusion, Digital Twins and Smart Oracles
10:30–10:45	Ajai Paul Selected speaker	Socio-Political Infrastructure as a Resilience Catalyst: Validating the Kerala Model for Neutralizing Epidemiological and Ecological Shocks in Kochi
10:45–11:00	Laura Simona Cotan Selected speaker	Urban Sustainability and the Role of the National Defence System
11:00–11:15	Tuhin Bhadra Selected speaker	Urban Resilience and Adaptation through Nature-Based Infrastructure: The Role of Peri-Urban Wetlands in a Warming City

S6. Urbanization and Social Development

Time: 13:00 (CEST, Basel)

Time (CEST)	Speaker	Title
13:00–13:10	Dr. Teodoro Georgiadis Session Chair	Welcome from the Session Chair
13:10–13:30	Dr. Kritika Rana Invited Speaker	Housing, Built Environment, and Health Equity: Implications for Urbanisation and Social Development
13:30–13:50	Prof. Dr. Alexandru-Ionuț Petrișor Invited Speaker	Challenges of green infrastructure planning: experience from comparative international studies
13:50–14:05	Gabriela Adriana Munguía-Urbe Selected speaker	Urban Identity under Touristification: The Semiotic Restructuring of Mexico City's Historic Centre
14:05–14:20	Millena Moreira Fontes Selected speaker	Municipal governance and the 2030 Agenda: An analysis of public policies in São Cristóvão, Brazil (2019–2025)
14:20–14:35	Azhar Iqbal Selected speaker	Impact of Urbanization on Social Development of Punjab
14:35–14:50	Meenu C V Selected speaker	Identity and Marginalisation in Urban India: Insights from the Census Data of Delhi
14:50–15:05	Tanvir Mahmood Selected speaker	The Nexus of Land Use Change, Urban Densifications, and Land Markets in Infrastructure-induced Regions: A Case Study on Bairag Union, Bangladesh
15:05–15:20	Adhitya Rizky Isnandya Selected speaker	Towards Equal and Equitable Low-Income Homeownership: Unravel Subsidized Housing Adaptation and Homeownership Effect in Bandung Metropolitan Area, Indonesia

22 May 2026 (Friday)

S2. Urban Environments and Sustainability

Time: 9:00 (CEST, Basel)

Time (CEST)	Speaker	Title
09:00–09:10	Prof. Dr. Eusébio Z. E. Conceição Session Chair	Welcome from the Session Chair
09:10–09:25	Martyna Kaniewska-Gołek Selected speaker	The Legal Invisibility of Visual Pollution in Poland: A Systemic Gap in Urban Environmental Protection
09:25–09:40	Polyxeni Mastoraki Selected speaker	Reclaiming Place: Human-Centered Urban Futures through Creative Sustainability
09:40–09:55	Abdulrahman Almajadiah Selected speaker	Evaluating Vegetation and Surface Treatments for Urban Heat Island Mitigation in Hot Desert Campuses: A Microclimatic Study of Najran University
09:55–10:10	Sreya R Nambiar Selected speaker	Urban Impacts on Avifaunal Community of Kannur Dist., Kerala, India
10:10–10:25	Md Saharik Joy Selected speaker	Urbanization, Vegetation Loss, and Biophilic Sustainability: A Geo-Statistical Investigation in Kolkata Metropolitan Area
10:25–10:40	Gang Ling Selected speaker	Spatio-temporal urban noise exposure at metro station entrances: a city-scale 24-h study in Shenyang
10:40–10:55	Antonio Peña-Fernández Selected speaker	Chromium In Urban And Peri-Urban Environments: Mushrooms And Soil As Biomonitoring Tools In Leicestershire, England
10:55–11:10	Wai Yie Leong Selected speaker	Kuala Lumpur Climate Action Plan Implementation Analytics: Programme Effectiveness, Co-Benefits, and Equity

S2. Urban Environments and Sustainability

S3. Urban Economies and Resource Management

Time: 14:00 (CEST, Basel)

Time (CEST)	Speaker	Title
S2. Urban Environments and Sustainability		
14:00–14:20	Prof. Dr. Nidhi Nagabhatla Invited Speaker	Bluebelts for Urban Sustainability: NYC's Nature-Based Stormwater Resilience
14:20–14:35	Mateusz Dudzik Selected speaker	Cement mortars with the addition of ash from municipal waste incineration as part of the circular economy
14:35–14:50	Prof. Dr. Veera Gnaneswar Gude Selected speaker	Evaluating the Synergy between Urban Agriculture and Local Resources
14:50–15:05	Ivana Sentić Selected speaker	From Urban Memory to (Un)Sustainable Vegetation Concept
S3. Urban Economies and Resource Management		
15:05–15:15	Prof. Dr. Meldina Kokorović Jukan On Behalf of the Session Chair: Prof. Dr. Lori Pennington-Gray	Welcome from the Session Chair
15:15–15:35	Prof. Dr. Umberto Berardi Invited Speaker	Building envelope Thermal Performance during Concurrent Heatwave–Urban Heat Island Conditions Using a Citywide Local Climate Zone Analysis
15:35–15:55	Prof. Dr. Meldina Kokorović Jukan Invited Speaker	Urban Futures in Transition: Rethinking Economies, Resources, and Resilience
15:55–16:10	Rutool Sharma Selected speaker	Urban Land as a Financial Resource: Lessons from Land Value Capture in Ahmedabad (India)
16:10–16:25	Mariza Tzouvali Selected speaker	Innovating DBL Business Models: Tokenomics, Smart Contract SLAs, Decentralised Knowledge Graphs and Smart Oracles
16:25–16:40	B.L.N.K. Madhurangi Selected speaker	Urban Economic Spillover Networks: Micro-Level Evidence of Functional Urban–Rural Integration in Sri Lanka

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16:40–16:55	Juan Jose Saldarriaga Selected speaker	Feasibility study for solid waste management using smart waste bins in the municipality of Cuernavaca, Mexico
16:55–17:10	Nitin Rathee Selected speaker	Regulatory Determinants of Urban Land Markets: A Comparative Analysis of Policy Impacts and Market Efficiency in India
<i>Closing Ceremony</i>		
17:10–17:20	Prof. Dr. Jianming Cai Dr. Jieling Xiao Conference Chairs	Closing Ceremony

Session 1. Urban Planning and Design

sciforum-172563: Urban Green Space Satisfaction in an Extreme Industrial City: Evidence from Coastal Park, Asaluyeh, Iran

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Urban parks in rapidly industrializing cities of West Asia face a triple challenge: extreme climate, limited green space, and populations fragmented by labor migration. Planning decisions in such contexts are rarely guided by empirical evidence on what drives user satisfaction. This paper reports preliminary findings from a case study in Asaluyeh, a petrochemical city on Iran's Persian Gulf coast, where summer temperatures exceed 45°C and per capita green space is just 0.44 m², less than one-tenth of international recommendations. Analysis identifies park characteristics that most strongly influence visitor satisfaction and highlights underserved population segments. Vegetation quality emerges as the strongest predictor of overall satisfaction ($r = 0.45$, $p = 0.001$), surpassing demographic and socioeconomic variables. Gender disparity is evident, with female visitors reporting lower satisfaction than males (3.5 compared with 3.9 on a 5-point scale; $t = 2.15$, $p = 0.045$), despite equal or greater preference for public green space. Visits are temporally concentrated, with 76% occurring on weekend evenings and only 2% during weekday daytime hours. Access is constrained by transport dependency, as 84% of visitors arrive by private car. Although 43% of respondents have private gardens, 79% prefer public parks, emphasizing their social and collective value. These findings are translated into a prioritized intervention framework for urban managers, offering guidance for investment based on empirically demonstrated effects on user satisfaction. This abstract presents preliminary findings from an ongoing study, and the full manuscript is currently under review for journal publication.



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sciforum-170576: From Self-Organization to Regulation: A Bio-Inspired Agent-Based Model for Integrated Urban Planning and Growth Management in Western Province, Sri Lanka

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Contemporary urban planning and design must respond to the intertwined challenges of net-zero development, biodiversity conservation, efficient land use, and wider social and economic demands. In this context, a critical planning question is not only where urban growth occurs, but also where it may be accommodated through relatively stable self-organizing processes and where stronger strategic or statutory intervention is required. This study develops a bio-inspired agent-based model as a planning-support tool to address this question in Western Province, Sri Lanka. Drawing on the adaptive behavior of *Physarum polycephalum*, the model translates gradient-following, path reinforcement, and decay into a simulation of urban expansion. Using an Inverse Generative Social Science approach, the model is calibrated against the observed 2025 built-up pattern, with growth simulated from the 1990 urban edge until the observed 2025 urban extent is reached. Development probability is defined by an attraction surface combining road proximity, land value, existing density, amenity accessibility, and slope suitability. The calibrated model reproduces 49% of the observed 2025 built-up area (Figure of Merit = 0.428; Kappa = 0.574), with road proximity emerging as the strongest driver of expansion ($w = 0.295$). Spatial error analysis shows that 62% of false negatives occur as fragmented patches, indicating areas where self-organizing growth alone does not adequately explain development. These areas are likely to require stronger policy guidance, regulatory control, or targeted design intervention. The study demonstrates how bio-inspired urban modelling can support integrated planning by identifying where growth may be accommodated, where it should be guided, and where regulation is necessary to protect environmentally sensitive and high-conflict areas.



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sciforum-170943: Integrating Chaotic Optimization and Machine Learning Algorithms for Precise Remote Sensing Maps of Oakland, California, using Sentinel-2 Multispectral Imagery

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The advancement of remote sensing technology has revolutionized urban planning and environmental monitoring, providing high-resolution spatial data essential for managing complex metropolitan areas like Oakland, California. However, the primary obstacle in achieving high-accuracy land cover classification is spectral heterogeneity. To address this, our research develops an advanced urban land cover mapping framework for an area of 51.88 km² in Oakland, California, using Sentinel-2 multispectral imagery. The primary objective is to enhance the performance of a Random Forest (RF) classifier by integrating chaotic optimization algorithms to fine-tune hyperparameters, thereby overcoming the limitations of traditional grid-search methods. Our study focuses on six distinct urban classes: High-Density Compact Urban, Large Low-Rise, Residential Open Low-Rise, Hillside Residential, Mixed-Use Transit Corridors, and Coastal Infrastructure. First, we developed and compared the hyperparameters and classification accuracy of a standard Random Forest Algorithm against a Chaotic Random Forest (CRF) variant. This comparison was conducted using three distinct built-up indices independently: the Modified Normalized Difference Built-up Index (MNDBI), the Built-up Area Extraction Index (BAEI), and the Normalized Difference Impervious Surface Index (NDISI). Second, the optimized parameters were applied to generate individual built-up classification maps for each index, assessing their sensitivity to Oakland's unique topography. Finally, a proposed fusion approach synthesized these results with additional environmental layers such as the Normalized Difference Vegetation Index (NDVI), the Modified Normalized Difference Water Index (MNDWI), and the Barren Soil Index (BSI) to create a final high-precision land cover map. Preliminary results indicate that the Chaotic Random Forest (CRF) model significantly outperforms the standard Random Forest (RF) model. Specifically, the CRF achieved an Overall Accuracy (OA) of 80.2% and a Kappa coefficient of 0.92 compared to the standard RF's OA of 76% and Kappa of 0.84.



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sciforum-170771: The Tale of Two Troys: A Comparative Sentiment Analysis of Visitor Experiences in the Ancient City and the Museum

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In the contemporary heritage paradigm, the visitor experience can be divided into the tangible authenticity of archaeological ruins and the digital narratives of modern museums. This distinction is particularly evident in Canakkale, Türkiye, which hosts both the UNESCO World Heritage Site of Troy and the award-winning Troya Museum. While these two entities interpret an identical historical timeline, they provide fundamentally distinct spatial and cognitive encounters. As Richards (2018) indicates, cultural tourism is rapidly shifting towards experience-based consumption, yet traditional monitoring methods including surveys and ticket sales fail to capture the qualitative perceptions of the digital-native visitor. To address this gap, Ghermandi and Sinclair (2019) advocate for passive crowdsourcing through social media as a real-time alternative to monitor visitor preferences. This study aims to reveal the digital image of Troy by analyzing User-Generated Content to determine whether visitor perceptions align with the management goals of the Troya. The research adopts a digital footprint approach (Girardin et al., 2008), and it utilizes TripAdvisor as the data source due to its rich textual depth. A balanced dataset of English and Turkish reviews (n=250) are harvested for both the "Ancient City of Troy" and the "Troya Museum". The text data are analyzed by conducting a pipeline of tokenization, stop-word removal, and normalization. The methodology combines methods from Natural Language Processing frameworks: first, Word Cloud visualization (Karayazi et al., 2022) maps the frequency distribution of dominant keywords. Second, VADER Sentiment Analysis (Hutto & Gilbert, 2014) quantifies satisfaction polarities. Reviews of the Troya Museum are expected to emphasize architectural quality and exhibition design (Metin Parlak & Celebi Seker, 2026). In contrast, reviews of the archaeological site are expected to mention environmental aspects, such as walking distances, climatic conditions, and engagement with the landscape (Oncul et al., 2023). As a result, this research proposes a data-driven experience model, and it supports the development of destination identity.



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sciforum-173586: Urban Governance and Urban Planning Parameters: An Interpretation of the Constitutional Court's Ruling on Housing in Lima, Perú

Paola Roxana Norabuena

¹ Pontificia Universidad Católica del Perú

Access to housing constitutes one of the main urban challenges in cities such as Lima Metropolitana, where population growth and urban expansion have outpaced the capacity of formal planning systems. In this context, zoning regulations and urban planning parameters, such as building height, density, and open space requirements, become key instruments in shaping the city. The so-called Urban Planning Parameters Case before the Constitutional Court represents a milestone in defining the allocation of powers between the Ministry of Housing, Construction and Sanitation (MVCS) and local governments.

This research adopts a qualitative approach based on the interpretative analysis of the Constitutional Court rulings in the Urban Planning Parameters Cases I, II, and III (Exp. 00017-2021-PI/TC; Exp. 00001-2021-CC/TC and 00004-2021-CC/TC; and Exp. 00003-2020-CC/TC), focusing on municipal authority over zoning, urban planning, and planning parameters in relation to national housing regulations and special regulatory frameworks. The analysis is developed from an urban planning perspective, assessing the implications of these decisions for urban planning processes and access to housing.

The findings indicate that constitutional jurisprudence consolidates a model of urban governance in which the MVCS establishes general regulatory guidelines, while municipalities retain autonomy in managing urban planning parameters and determining maximum building heights. This study contributes to the broader discussion on access to housing and the development of Social Interest Housing (VIS) projects. Furthermore, it highlights the existing fragmentation across different levels of urban planning and offers a critical reflection aimed at improving coordination and the formulation of future urban policies.



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sciforum-173801: A Study on Public Open Spaces in the Ger Districts of Ulaanbaatar city

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Ger districts in Ulaanbaatar accommodate approximately 30% of the city's population and are steadily expanding into the city's outskirts. They are primarily inhabited by former nomadic households undergoing a rapid urban transition. This transformation has led to spatial and social challenges, particularly a deficiency in public open spaces. Access to multifunctional recreational spaces is of paramount importance for fostering community interaction, improving public health, and enhancing the overall quality of urban life. However, the scarcity of recreational and green spaces in ger districts constrains everyday life and weakens the social infrastructure necessary for community well-being. Based on theories of public space and sustainable urban development, this study examines the demand for public open spaces in ger districts through questionnaire surveys and field observation. The study evaluates residents' spatial needs, usage patterns, and perceptions of environmental quality. The findings reveal that a critical shortage of recreational areas, playgrounds, sidewalks, and accessible green spaces, limiting opportunities for social cohesion and restorative experiences. In addition, residents tend to utilize water kiosks and local grocery stores as gathering places and landmarks. The study argues that the strategic integration of inclusive, multifunctional public open spaces should be considered a priority in the sustainable redevelopment of ger districts. Such spatial interventions are essential not only to improve environmental performance but also to strengthen social resilience and enhance long-term urban livability.



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sciforum-169389: ARCHITECTURAL CONTRIBUTION TO ECO-FRIENDLY PARK DESIGN AND WETLAND CONSERVATION IN MUSANZE: A CASE OF MPENGE WETLAND

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The Mpenge Eco-friendly Park and Wetland Conservation Project is proposed in Musanze District, Northern Province of Rwanda, a region recognized for its tourism potential and ecologically valuable wetland systems that provide critical environmental services, including water regulation, biodiversity conservation and agriculture support. In recent decades, rapid urbanization has contributed to a significant decline in wetland coverage, with more than 20% lost over the past two decades, posing serious ecological and socio-environmental challenges. This study investigates the role of architectural design in the development of eco-friendly parks that address recreational needs while actively contributing to wetland conservation and ecological restoration.

Using a design-based research approach supported by site analysis, ecological assessment and sustainable architectural principles, the proposed park integrates strategies such as permeable surface systems, rainwater harvesting and native vegetation restoration to enhance environmental performance and ecological resilience. The project prioritizes multifunctional architectural spaces, including eco-friendly parks that address recreational needs while actively contributing to wetland conservation and ecological restoration. The project also prioritizes multifunctional architectural spaces, including eco-restaurants, pavilions and flower gardens designed to promote environmental education, social interaction and community wellbeing while minimizing ecological disturbance.

The project aims to achieve a 10% increase in local biodiversity within five years and is projected to attract over 50,000 visitors annually, strengthening eco-tourism and local economic development in Musanze. Community participation is embedded through conservation initiatives such as monthly Umuganda activities focused on wetland restoration, tree planting and environmental stewardship. The findings demonstrate that architectural interventions, when strategically integrated with ecological restoration frameworks, can serve as effective tools for wetland preservation and sustainable urban development. The Mpenge Eco-Friendly Park positions Musanze as a replicable model for eco-friendly urban parks that balances environmental protection community engagement and socio-economic sustainability in Rwanda and similar contexts.



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sciforum-159499: Architectural Heritage and the Formation of a Layered Cityscape. The case of the Asia Minor Refugee settlements in Attica, Greece

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The Housing Rehabilitation of the Asia Minor Refugees (1922–1980s) produced some of the most distinctive **layered urban landscapes** in the Attica basin and other Greek cities. This paper—based on literature review, archival research, and extensive fieldwork including photographic documentation and spatial mapping—examines the evolution of these settlements and the present condition of their built environment. Emphasis is placed on their **architectural and urban-design qualities**, which constitute a vital yet undervalued part of Greece's **tangible cultural heritage**. These settlements feature a rich range of **architectural morphologies**: vernacular influences and Asia Minor construction traditions coexist with early examples of **Modernism and Bauhaus-inspired social housing**, characterized by clarity of form, human-scaled layouts, and distinctive architectural details rarely found in contemporary buildings. These characteristics form a unique, yet fragile, heritage corpus, contributing significantly to the cultural identity of the urban landscape. Despite their importance, **most Asia Minor Refugee districts are not listed as monuments**; only a limited number of buildings or ensembles are protected under formal protection. Consequently, they face deterioration, piecemeal alterations, and redevelopment pressures that threaten their integrity.

The findings underscore the need to integrate them into a **cultural sustainability** framework—one that recognizes their architectural and urban-design value and ensures that these historic layers remain active components of the evolving city.



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sciforum-172582: ASSESSING URBANITY THROUGH AN INTEGRATED MULTIDIMENSIONAL FRAMEWORK: IMPLICATIONS FOR URBAN CLASSIFICATIONS

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Accurately defining urbanity is essential for effective urban analysis and spatial planning, but conventional approaches often fail to capture the complexity of dynamic urban systems. Many existing studies assess urbanity alone through a single approach, like morphologically or socio-economically, and many countries continue to rely on rigid administrative classifications that inadequately reflect functional and socio-spatial realities. As a result, emerging and transitional urban areas are frequently misidentified, leading to planning inefficiencies and resource misallocation. In response, this study conceptualizes urbanity as a multidimensional continuum and develops an integrated analytical framework to better capture true urban characteristics. The framework combines two complementary indices, a Morphological Urbanity Index (MUI) derived from density, diversity, and accessibility, and a Lifestyle-Based Urbanity Index (LUI) constructed using census-based socio-economic indicators, service accessibility measures, and geospatial proxies such as night-time lights and point-of-interest density. All indicators were normalized and integrated within a GIS (Geographic Information System) environment using raster-based overlay techniques and fuzzy logic modeling. The framework was empirically tested in Kandy District, Sri Lanka, and validated through spatial comparison with existing administrative classifications. Results indicate that urbanity differs when assessed through form-based and lifestyle-based indices. Integrating these dimensions produces a more comprehensive understanding by capturing both spatial structure and lived experience. The resulting urbanity continuum reveals varying intensities of urban characteristics across space, challenging the conventional urban–rural dichotomy. Comparative analysis with administrative boundaries identifies significant spatial mismatches, exposing patterns of hidden urbanization in officially classified rural areas. The study demonstrates that measuring urbanity through an integrated multidimensional framework provides a more realistic representation of contemporary urban conditions. Although tested in Kandy District, the proposed approach is scalable and adaptable to diverse global contexts, supporting improved urban classification and evidence-based spatial planning.



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sciforum-172385: Assessing Visual Connectivity at Property Crime Hotspots in Nashik City

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Understanding the spatial structure of urban environments is essential for identifying conditions that facilitate or deter property crimes. This study assessed visual connectivity at property crime hotspots (PCHs) in Nashik City, India. Property crime data, including robberies, burglaries, and thefts, were obtained from the Nashik City Police Department, while building footprint data were sourced from Google Open Buildings. Using QGIS, property crime locations were mapped, and hotspot areas were identified. Neighborhood layouts were then developed around these hotspots, and Visibility Graph Analysis (VGA) was performed in depthmapX to assess visual connectivity within 50-meter buffers of property crime locations. The analysis revealed spatial variations in visual connectivity across different PCHs, highlighting how the spatial configuration of neighborhoods influences surveillance and creates opportunities for property crimes. Areas with lower visual connectivity often corresponded to more property crimes, suggesting that restricted visibility due to compact spatial layouts may provide favorable conditions for property crime incidents. Conversely, locations with higher visual connectivity demonstrated fewer property crimes, indicating the positive influence of natural surveillance. The findings underscore the potential of space syntax-based visual analysis as a diagnostic tool for property crime prevention. By integrating spatial configuration analysis of neighborhoods with property crime mapping, this study provides a methodological framework for urban planners and urban designers to identify vulnerable areas and design interventions that enhance street visibility, spatial integration, and safety in urban neighborhoods.



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sciforum-173717: Cities for People: Walkability Analysis in the Surroundings of Óvalo Gutiérrez, Miraflores District

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Óvalo Gutiérrez is an emblematic node in the Lima district of Miraflores, as it attracts a significant pedestrian flow due to its diversity of uses and its proximity to a major landmark, Huaca Pucallana. However, its streets primarily respond to vehicular logic, which reduces comfort and safety for pedestrians. Therefore, measuring walkability in its surroundings becomes necessary in order to improve the pedestrian experience through a verifiable diagnosis.

This research replicates the methodology developed in *Identifying and Measuring Urban Design Qualities Related to Walkability* (Ewing et al., 2005). Through fieldwork conducted across different street segments, five key urban design qualities were analyzed: imageability, enclosure, human scale, transparency, and complexity. The survey was documented using videos and photographs, and the collected data were transferred to a scoring sheet from which walkability results were obtained for each segment.

The results identified streets with high levels of walkability, suitable for pedestrian prioritization and for strengthening connections between centralities, as well as sectors with low levels that require specific public space interventions. The study provides a quantitative and cartographic diagnosis of the area surrounding Óvalo Gutiérrez, identifying priority spaces for intervention. Furthermore, replicable guidelines were developed for similar road nodes in Lima, contributing to a planning approach that places people at the center of urban development.



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sciforum-172613: Data-Driven Urban Growth Projections for Cox's Bazar, Bangladesh: Insights from Machine Learning and GIS

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The goal of this study is to predict urban growth in Cox's Bazar, Bangladesh, through 2050 using historical land-use patterns, geospatial data, and machine learning techniques. Multi-temporal Landsat imagery (1990–2020) was used to classify land cover into urban, vegetation, water, and bare land. Key drivers influencing urban expansion, population density, distance to roads, elevation, slope, distance to coast, and proximity to existing urban areas were extracted and processed in a geospatial environment. By analyzing these factors together, this study identifies patterns and trends in urban expansion that can inform planning decisions. The approach also highlights areas at risk of rapid, unplanned growth, providing a basis for proactive urban management and sustainable development strategies. Random Forest (RF) will be used to quantify the relative importance of candidate drivers of urban growth, and a Cellular Automata–Markov framework will be applied to simulate future urban expansion using transition probabilities derived from multi-temporal land-use/land-cover (LULC) maps. Model validation will be conducted using Kappa statistics and strong overall accuracy. The simulations will generate projected urban extent for multiple future time horizons (2030, 2035, and 2040). Hotspot analyses will be used to detect areas of rapid urbanization, which are hypothesized to cluster along major road corridors, at peri-urban interfaces, and around refugee settlements. This study demonstrates that combining GIS, remote sensing, and machine learning provides quantitative, data-driven forecasts that can guide sustainable urban planning, infrastructure development, and environmental management in rapidly growing coastal cities.



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sciforum-172608: Developing An Objective Approach for Context-Sensitive Building Line Determination: A Planning and Spatial Decision-Support Tool

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Building lines are a fundamental development control used to regulate the spatial relationship between roads and adjacent buildings, influencing safety, infrastructure expansion and streetscape character. In Sri Lanka, building lines are typically determined using fixed distances or professional judgement, resulting in inconsistent and non-contextual decisions. The absence of a systematic analytical method limits transparency and weakens the effectiveness of planning regulation. This study proposes an objective, context-sensitive approach for building line determination using spatial data and computational modelling.

A mixed-methods framework was adopted. First, legislative documents and international practices were reviewed to establish the conceptual basis of building line regulation. Expert interviews were analysed through thematic analysis to identify influential determinants, followed by a Delphi-informed validation with multi-institutional practitioners. The validated factors were translated into spatial variables using GIS datasets and incorporated into a machine-learning-based predictive model to estimate appropriate building line distances.

Six key determinants were confirmed: road geometry and traffic capacity, development pressure and density, land use and zoning, road hierarchy and connectivity, future development proposals and population, and urban form characteristics. The model successfully generated context-responsive building line values, demonstrating improved consistency compared with fixed-distance practices. Sensitivity and expert validation indicated that the approach better reflects urban character and regulatory intent.

The research establishes a data-driven decision-support tool for building line determination, enhancing transparency, reliability and contextual responsiveness in planning control. The framework provides a replicable methodology for integrating expert knowledge, spatial analysis and machine learning into regulatory planning practice, supporting more coherent and adaptable urban development.



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sciforum-162960: Evaluating Safety and Inclusivity in Park Design Through Women's Safety Priorities Index (WSPI)

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Women's experiences of safety and comfort in urban parks are shaped by interrelated design, environmental, and social factors that are rarely captured in a single evaluative framework. Focusing on neighbourhood parks in Amman, Jordan, this study develops the Women's Safety Priorities Index (WSPI), a composite indicator designed to assess how women perceive the safety, accessibility, and inclusivity of these everyday public spaces. Survey data were collected from female park users and grouped into key dimensions including lighting, signage, visibility, isolation, accessibility, facilities, environmental quality, and motivation to visit. Item scores were normalised to a common scale, with isolation reversed so that higher values consistently reflected more women-friendly conditions, and then aggregated into dimension-level sub-indices. These sub-indices were combined into an overall WSPI using data reduction techniques to derive empirical weights, and internal consistency checks were conducted to ensure reliability. A priority improvement matrix was constructed by jointly considering central tendency and variability for each dimension, and further analysis examined differences across age, marital status, and employment groups. The findings indicate that accessibility, signage, and lighting are perceived as comparatively strong aspects of neighbourhood park design, while environmental quality, the availability and condition of facilities, motivation to visit, and feelings of isolation are weaker and require more urgent attention. Priority analysis highlights facilities and environmental quality as primary targets for intervention, with visibility, motivation, and isolation forming a second tier of concern. Demographic patterns show that younger women place particular emphasis on lighting and visibility, married women are especially sensitive to accessibility and reduced isolation, and employed women place greater value on facilities and environmental comfort. Overall, the WSPI translates complex perception data into actionable insights, supporting planners and policymakers in Amman and similar cities in prioritising gender-responsive improvements in neighbourhood park design and management.



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sciforum-175247: From Proximity to Performance: An Empirically Calibrated Grid-Based Model of Age-Friendly Walkability in Alvalade, Lisbon

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As European cities age, the challenge extends beyond ensuring older adults can reach essential services to understanding how urban environments support their movement, rest and cognitive engagement in public space. The 15 min city framework emphasizes access to services but often overlooks environmental comfort, spatial legibility and how older adults actually use public space. Existing accessibility metrics systematically mispredict elderly spatial engagement because they ignore micro-scale environmental and configurational factors. This study addresses this gap by developing a grid-based urban walking comfortability model for the neighbourhood of Alvalade in Lisbon. The analysis is conducted using a 100 m × 100 m geospatial grid to capture fine-scale variations in the urban fabric. The work proceeds via three methodologies: 'Functional Accessibility Overlays', 'Environmental and Cognitive Layer evaluation' and finally 'Behavioural Validation' by Computer Vision. All indicators are standardized and systematically integrated into a weighted Age-Friendly Comfort Walkability Index. Our findings suggest that proximity alone does not ensure engagement. This study proposes and empirically validates a calibrated spatial performance model. By linking infrastructure, spatial configuration and behavioural evidence, the proposed framework offers a practical tool for planners with an actionable, data-driven tool to embed holistic environmental comfort within sustainable neighbourhood strategies also fostering equitable and age-friendly urban environments.



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sciforum-165982: Land use–based spatial planning structure of the MULS Campus in the urban ecosystem

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In the Strategic Development Plan of the Mongolian State University of Agriculture for 2018–2028, one of the eight priority directions is the improvement of the university environment and the enhancement of the quality and accessibility of buildings and facilities. The primary objective of our study is to develop a scientifically grounded spatial planning solution to create a comfortable, favorable environment for students, faculty, and staff.

Within the framework of the research, an assessment of the land-use structure and the current state of the “KHAAN” campus of the Mongolian State University of Agriculture was conducted. Based on field measurements, aerial imagery obtained through unmanned aerial vehicles, and remote sensing methods, we developed an environmentally oriented planning proposal aligned with the requirements of an urban ecosystem and integrated into an optimized land use scheme.

The results of the study allowed us to compare the current condition of the campus with model examples of campuses at several international universities, thereby identifying the potential for developing a territorial plan based on functional zoning. The “KHAAN” campus occupies 22.25 hectares, with land use distributed as follows: educational facilities – 30%, green infrastructures – 14.1%, road infrastructure – 8.3%, office and administrative buildings – 6%, and residential areas – 10.1%.

As a result of the planning analysis, which considered the existing land-use structure, the areas designated for economic activities, residential zones, parking lots, and educational facilities were partially reduced. Instead, the project includes new functional elements such as a pedestrian “light street,” expanded green areas, a student development center, bicycle parking facilities, an agricultural innovation and technology center, as well as public spaces for recreation and leisure.



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sciforum-172114: Open-Data GeoAI for Short-Term Urban Land-Use/Land-Cover Forecasting in Rapidly Growing African Cities: A Reproducible Workflow and the Kinshasa (DRC) Case Study

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Rapid urban growth in many African cities frequently outpaces official mapping and monitoring, limiting evidence-based urban planning in data-scarce contexts. This study develops and tests a fully open-data, reproducible geospatial artificial intelligence (GeoAI) workflow to forecast short-term urban land-use/land-cover (LULC) change, using Kinshasa (Democratic Republic of the Congo) as a demonstrative case study. Multi-temporal LULC maps for 2016, 2019, 2022 and 2025 were produced at 10 m resolution from Sentinel-2-derived Dynamic World Version 1 in Google Earth Engine and combined with open explanatory variables derived from NASADEM topography and OpenStreetMap proximity layers. Transition potentials were modelled in TerrSet Land Change Modeler using a multilayer perceptron (MLP) and a support vector machine (SVM) and then integrated with Markov-chain allocation to simulate near-term scenarios for 2028 and 2031 (three-year steps). From 2016 to 2025, built-up areas increased by approximately 114.48 km², while vegetation and croplands declined by about 149.64 km² and 50.80 km², respectively, with the most dynamic changes occurring during 2019–2022; vegetation was the principal donor class to urban conversion (≈110.65 km²). Predictive performance was high, with area-under-the-curve values exceeding 0.89 and overall Kappa statistics ranging between 0.78 and 0.83, indicating reliable short-term forecasting skill. The projected maps for 2028 and 2031 suggest continuing peri-urban sprawl and progressive fragmentation of vegetated zones, demonstrating that open-data GeoAI can deliver actionable, transferable spatial foresight for rapidly growing African cities.



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sciforum-175942: Reclaiming Fragmented Urbanism in Dhaka, Bangladesh: A Data-Driven Evaluation of Infrastructural Voids and Strategic Pathways for Redesign

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Rapid urbanisation in Dhaka has created extensive infrastructure gaps. Residual spaces produced by large-scale transport infrastructure and neglected waterway corridors remain formally unacknowledged yet functionally embedded in the city's informal social fabric. Despite their apparent emptiness, these sites serve as critical nodes of everyday urban life for marginalised communities. This paper evaluates the spatial conditions, ecological degradation, and latent social value of four recurring void typologies in Dhaka: street nodes adjacent to canal edges, land beneath flyovers under construction, voids beneath existing flyovers with informal sanitation facilities, and waste-accumulating plots along waterway margins.

A standardised field data-collection framework was employed across all four site typologies, documenting physical and environmental conditions, as well as the demographic profiles and behavioural patterns of current users. Observational mapping, structured surveys, and spatial measurements were used to capture both the formal neglect and the informal vitality characterising each site.

Field evidence demonstrates that all four typologies sustain consistent, high-frequency informal activities, including vending, transit waiting, waste sorting, and community gathering, despite the absence of any planned programming or basic amenities. Regardless of the unfavourable environmental conditions, including poor drainage, heat exposure, inadequate sanitation, and existing social vulnerabilities, the users are most dependent on these spaces on a daily basis.

The findings indicate that Dhaka's infrastructural voids represent a systemic planning failure that disproportionately affects low-income and transient populations. Targeted, community-responsive redesign strategies informed directly by documented behavioural patterns can transform these neglected sites into equitable public assets. This research contributes an evidence-based framework for integrating infrastructural and ecological voids into Dhaka's broader urban fabric, advancing more inclusive and resilient city-making.



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sciforum-172802: Reconciling Net-Zero Aspirations with Informal Settlement Proliferation: A Spatial Analysis of Strategic and Statutory Planning Instruments in Kitwe, Zambia

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Introduction: Sub-Saharan African cities confront the dual imperative of decarbonisation and poverty alleviation, yet planning instruments designed to reconcile these objectives remain inadequately evaluated in mining-dependent contexts. Kitwe, Zambia's second-largest city, exemplifies this tension: its Integrated Development Plan (2023–2033) projects a population exceeding one million by 2035, while nineteen informal settlements accommodate most low-income residents outside statutory coverage. Strategic net-zero commitments under the Green Economy and Climate Change Act No. 18 of 2024 and NDC 3.0 must be operationalised within the Urban and Regional Planning Act No. 3 of 2015, yet bridging mechanisms between strategic intent and statutory enforcement remain critically under-examined.

Methods: A mixed-methods approach integrates geospatial analysis of land use/land cover change (1990–2020) from Landsat imagery with a systematic policy content analysis of Kitwe's IDP, the 8th National Development Plan, and allied instruments. Spatial metrics quantify the expansion of informal settlements relative to zoned biodiversity corridors, mine buffer zones, and green infrastructure networks. Semi-structured interviews with planning officers, ward councillors, and community leaders triangulate institutional barriers to implementation.

Results: Analysis reveals that 45.2% of Kitwe's district area underwent land-cover change over 30 years, with built-up expansion concentrated in former miombo woodland classified as biodiversity-priority. Indigenous forest cover declined 24.9% between 1990 and 2015. Statutory planning covers fewer than 30% of actively developing peri-urban zones, creating governance vacuums enabling settlement encroachment onto contaminated tailings-adjacent land. A critical disconnect emerges between national net-zero commitments and the absence of enforceable local area plans that translate them into spatially binding development controls.

Conclusions: Kitwe's planning system exhibits dual-track failure: strategic instruments lack statutory enforceability, while statutory instruments lack spatial reach into areas of greatest development pressure. Achieving integrated net-zero and pro-poor outcomes requires binding local area plans co-produced with informal settlement communities, supported by biodiversity offset mechanisms tied to mining licence conditions and by circular land-use frameworks.



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sciforum-175984: Regulatory Compatibility of Commerce in Industrial Land: Spatial Analysis of the Meiggs Sector, Cercado de Lima

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The Meiggs sector, located in Cercado de Lima, is a historically industrial area where productive, commercial, and medium-density residential activities currently coexist, shaping a diverse and evolving urban fabric. Within the framework of the Metropolitan Development Plan of Lima and Callao (PLANMET), a significant portion of this area is classified as Consolidated Urban Land (SUC) and, specifically within its industrial strip, as Urban Transformation Land (SURT), a planning category intended to promote land reconversion and densification toward mixed uses.

In this context, the increasing residential and commercial presence, in contrast with industrial plots characterized by low permeability and limited urban integration, reveals an ongoing functional transformation. This process challenges the consolidation of a more active and mixed urban fabric, generates an imbalance between the prevailing industrial structure and the current patterns of urban occupation and use.

This research examines the sector within the broader framework of metropolitan urban planning, evaluating the coherence between zoning regulations, the existing regulatory framework and the actual land use observed in the study area. In the first phase, the compatibility tables established in the municipal ordinance and PLANMET were systematically reviewed. In the second phase, a detailed survey of commercial establishments within the defined study polygon was conducted. Each establishment was georeferenced using QGIS to construct a spatial database classified according to homogeneous typological criteria. Subsequently, a comparative analysis between actual land use and regulatory compatibility was performed, allowing for the objective calculation of the percentage of compatible activities.

The analysis determines the level of regulatory compliance and identifies spatial patterns associated with transitional urban fabrics, including their georeferenced distribution across the area. The findings provide technical criteria to support the management of industrial land undergoing transformation and strengthen decision-making processes aimed at consolidating mixed-use development in accordance with PLANMET guidelines.



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sciforum-173358: Reshaping Urban Design: SME Relocation under Istanbul's Zoning Reforms

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This study investigates how zoning reforms and environmental plan revisions in Istanbul have transformed urban design and displaced small and medium-sized enterprises (SMEs). Drawing on official demographic statistics, business license data, and municipal planning reports, this research maps SME relocation patterns across districts such as Zeytinburnu, Kartal, Bayrampaşa, Başakşehir, and Beylikdüzü. These case studies reveal a push-pull dynamic in which SMEs are forced out of traditional industrial zones due to rezoning decisions and rising land values, while being drawn into peripheral areas with lower costs but weaker infrastructure.

The analysis combines quantitative evidence from TÜİK ADNKS, TOBB SME reports, and BTK infrastructure data with spatial visualizations of the 1/100,000 Environmental Plan revisions. Figures and maps illustrate how land-use changes reshape the city's economic geography, highlighting the intersection of planning decisions and enterprise competitiveness.

Findings suggest that current planning frameworks prioritize large-scale redevelopment while overlooking the resilience of SMEs, which constitute the backbone of Istanbul's economy. This paper argues for urban design strategies that integrate economic resilience into planning, ensuring that zoning reforms do not undermine local enterprise sustainability. By linking spatial transformation to economic outcomes, this study contributes to debates on inclusive urban development and the role of planning in shaping equitable cities.



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sciforum-169394: Sensory urbanism: A multi-sensorial framework for reading Market streets

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Most of city life happens in public spaces such that sensory experiences are central to the design of urban built environments. However, the visual hegemony often overlooks the contribution of non-visual sensory dimensions to spatial experience. This research addresses this gap by developing a multisensorial framework for reading and designing urban public spaces, using market streets in Kerala as the contextual setting. Market streets are inherently rich sensory environments, shaped by intense pedestrian activity, vibrant commercial edges, diverse user groups, microclimatic conditions and temporal changes.

The theoretical foundation is drawn from visual and non-visual urban theories. The visual dimension is informed by Kevin Lynch's concepts of imageability and wayfinding; Gordon Cullen's serial vision and non-visual theories are derived from the works of Juhani Pallasma, Mirco Zardini, David Howes, Sarah Pink, and Kate McLean. By conceptualising market spaces as a spatial and sensory construct, the research develops a theoretical framework that links tangible elements and sensory parameters such as visual, auditory, olfactory, tactile and thermal cues to understand how spatial form and human perception interact to shape place meaning and memory. To operationalise this framework, the study uses a mixed-method approach combining binary surveys, photo elicitation, participatory sensory mapping, field observations, radar charts, and a sensory wheel to document the intensity and quality of sensory stimuli. The data collected from selected market streets is synthesised through a sensory matrix that evaluates each sense based on spatial context, temporal changes, and sources of stimuli. This matrix helps identify both desirable and undesirable sensory landmarks and identify the impact of sensory cues on legibility, orientation and place attachment. The outcome of the research is a multisensory mapping framework that can guide design decisions for urban streets, enabling planners and designers to improve the spatial experience through enhanced sensory comfort.



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sciforum-165494: Spatial Modelling of Indian cities by parameterising building codes - A Case Study of Navi Mumbai

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This research presents a comprehensive framework for the spatial modelling of Indian cities through the algorithmic translation of statutory planning regulations into three-dimensional urban form. With a specific focus on Navi Mumbai as a prototypical case study, the work develops a regulation-sensitive, procedural digital shadow that simulates both present and future urban morphology. By parameterising the Unified Development Control and Promotion Regulations (UDCPR), the model integrates plot-level geometry, building control norms, and development plan data to generate regulation-compliant, rule-based predicted 3D built form. An architectural typology classification system is formulated based on plot size—monoblock, perimeter block, and colony structure—and these forms are encoded into Computer Generated Architecture scripts. A heterogeneous dataset is compiled to construct a baseline 2018 model and the model generates a hypothetical redevelopment scenario for 2038 and 2058 horizon years. Model evaluation is undertaken through quantitative comparison with development plan population projections, visual validation against the actual built environment, and procedural compliance with the UDCPR. The model encompasses various analytical applications, such as redevelopment potential mapping, shadow and daylight simulation, and urban density analysis. A demonstrative application shows how the model integrates with environmental simulation tools to assess performance-based planning outcomes like annual daylight hours. The future scenario reveals a significant morphological shift from mid-rise to high-rise typologies, with an increase in built-up area from 0.54 to 1.85 million sqm, and a projected population escalation from 0.34 to 1.08 million. The paper also explores the implications of such modelling tools for sustainability, resilience and infrastructure forecasting while identifying the limitations of deterministic procedural models. This research aims to bridge the current gap between static regulatory documents and the dynamic realities of urban transformation.



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sciforum-173425: Stadiums that ignore the city: Land use analysis and safety perception in two of main sports infrastructures of Lima (Peru).

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Sports infrastructures are often perceived as disruptive facilities, as they generate urban voids, traffic disorder, and underutilization after competition days. The problem lies in a functionalist zoning that approached the sports venue as an isolated object, ignoring its potential as a source of urban complexity. In this sense, the morphological fabric of the city of Lima (Peru) has been radically transformed by these sports infrastructures, which have generated a problem in the perception of safety and accessibility for women and vulnerable groups navigating these environments.

The present study develops an analysis of land use and urban perception of six representative stadiums in the city of Lima during the 2014-2024 period: Nacional and Monumental stadiums. In a first stage, the Shannon Diversity Index (H) is used to characterize urban complexity (Rueda, 2012) in the immediate surroundings of these infrastructures (500-meter pedestrian isochrone). In a second stage, a mapping of "blind spots" is carried out from a safety and gender perspective.

Preliminary results suggest that the Nacional stadium presents a higher H index (3.2 bits) due to natural surveillance, while peripheral stadiums like the Monumental show high entropy and land-use segregation, as 70% of the immediate area is allocated to inactive parking lots. Consequently, the study identifies urban management models that transform sports complexes into equitable and complex nodes of public life.



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sciforum-172760: Strategic Two-Player Decision-Making for Residential Density Planning: Game-Theoretic Decision Structures in Urban Contexts

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Residential density planning is a core instrument of urban planning, land-use intensity, built form, infrastructure demand, and long-term sustainability outcomes. Although residential density limits are defined through planning regulations which the density ultimately realised in development projects emerges through strategic interactions among stakeholders. Within this environment, the most influential interaction occurs between the actor requesting development density and the government authority responsible for approving density within regulatory limits. Understanding how strategic decisions taken by these two key players shape residential density outcomes remains an important challenge in planning practice.

This study examines strategic two-player decision-making in residential density planning using game-theoretic decision structures and the research focuses on how optimum residential density levels are achieved within a fixed regulatory envelope, where planning controls define permissible development capacity. Within these constraints, multiple density configurations remain feasible, enabling density to be realised through alternative vertical, horizontal, or combined strategies. The study simulates how density requests and approval responses interact under such rule-defined conditions. Two decision structures commonly observed in planning practice are examined as simultaneous decision-making, where both players act without knowledge of the other's choice, and sequential decision-making, where one player's action follows observation of the other's move.

The findings show that decision structure significantly influences stakeholder behaviour and the stability of residential density outcomes. Simultaneous decision structures tend to encourage balanced strategic responses and more consistent realisation of optimum density levels, while sequential structures introduce strategic asymmetry that can lead to less stable density configurations. By explaining how two-player decision structures operate within regulatory limits, this study contributes a clearer understanding of strategic decision-making processes in residential density planning and supports more rational and effective urban planning practice.



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sciforum-170444: The *Phukhus* of Kathmandu Valley: Exploring traditional ponds through the lens of Biophilic Urbanism

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Biophilic Urbanism is a design approach that prioritises human–nature relationships within urban environments. Along with other natural elements, water-related features, such as rivers or oceans, and even man-made water bodies like ponds, fountains or water spouts, exhibit the potential to foster this relationship across neighbourhoods and cities. Kathmandu Valley has a rich history of urban water architecture and demonstrates a strong integration of water bodies in the planning and design of its traditional towns. This paper examines the role of water bodies in fostering Biophilic Urbanism in the valley with a particular focus on the provision, use and management of the ponds (*pukhus* in local language) based on the data collected from secondary sources, observations and questionnaire surveys with the users. Findings show that the ponds are essential components of a larger hydrological, social and ecological system of a town that influenced the development of settlement patterns and the network of public spaces. These ponds were strategically placed within residential neighbourhoods, urban nodes and temple complexes to function as a multiuse urban amenity, allowing residents to interact with them on a daily basis. In addition to being an important element of the valley's unique water management system, these ponds are deeply connected to the cultural and religious practices of the people and stand as a testimony of 'ecological intelligence'. While these historical ponds face critical threats in the aftermath of rapid and uncontrolled urbanisation in recent decades, their continuous functioning through preservation and regular maintenance is of the utmost importance to uphold their cultural, religious and ecological values. This could be a significant step in pursuing Biophilic Urbanism to create resilient and sustainable cities in contemporary times.



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sciforum-168940: The Quantified Public Realm: Applying Principal Component Analysis (PCA) to Urban Placemaking in Mumbai's Bandra-Kurla Complex

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Urban placemaking is a transformative way of thinking about urban development, focusing on how people experience, use, and identify with public spaces to create social cohesion and economic vitality. However, in reality, it has been a fragmented process, being implemented as design interventions rather than a governance process. Conventional urban placemaking analysis tends to be qualitative and design-focused, failing to provide the statistical depth necessary for large-scale governance and policy intervention. This paper proposes a statistically proven "Placemaking Equity Model" developed through a Principal Component Analysis (PCA) of Mumbai's most prestigious Central Business District (CBD), the Bandra-Kurla Complex (BKC). The study reduces 30 complex placemaking variables to six fundamental components, accounting for 83.10% of the variability in user perception. The results indicate a substantial "Access-Sociability Gap," in which the presence of "world-class infrastructure" (accounting for 46.24% of the variability) obscures a profound deficiency in human-scale social interaction.

Principal Component Analysis (PCA) serves as a key statistical tool in this study, enabling a transition in urban development from subjective, design-led interventions to an objective, evidence-based governance framework. This paper highlights the need for a paradigm shift in urban governance, employing Principal Component Analysis (PCA) to transition from engineering-led urban development toward evidence-based, governance-driven place management. This model can implement a long-term placemaking vision, ensuring that economically successful areas such as BKC become vibrant and socially resilient spaces.



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sciforum-175637: Unaffordable by Design

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Are our planning and housing systems contributing to the wealth divide in Australia, making our post code one of the strongest predictors of life outcomes in this country? This paper investigates how long-standing features of Australia's planning and housing delivery frameworks keep the "Bottom Million" at the bottom. It also highlights how small, strategic adjustments could unlock meaningful change across Queensland.

Drawing on Paul Collier's idea of the bottom billion, adapted locally by Noel Pearson, this perspective gives shape to the growing population shut out of secure, affordable housing in both public and private spheres.

As social housing becomes harder to access and private market competition intensifies, a significant cohort of Queenslanders is being left behind—stranded in a space where options shrink and the housing shortage feels increasingly insurmountable.

And the divide is widening, particularly with the flow of the great inheritance.

Through targeted scenario testing, this paper uncovers the correlations and hidden drivers that shape housing accessibility and reveals where the system can be shifted to make a real difference.

Another essential dimension is participation: does the current planning system make it harder for the Bottom Million to be heard? Whose submissions actually influence development applications? Whose voices prevail in community consultations? Perhaps this divide is not only about age but also about wealth—deepening an economic split between those with influence and those rendered invisible.

This work is not about assigning blame but rather the systemic causes. Real-world examples and actionable recommendations will help show what meaningful progress can look like.



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sciforum-171711: Urban fragmentation and reconfiguration: a multi-scale analysis of post-socialist Oradea

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Cities are complex spatial organisms shaped by long-term historical, political, socio-economic, or geographic factors. Urban form reflects successive phases of development that correspond to broader historical and ideological contexts. Over time, a wide range of approaches has been developed to analyse urban form and urban context, including historical approaches, analytical approaches, and recent historic urban landscape frameworks. However, the debate about post-socialist cities remains a long-term debate regarding the term *per se* or its urban form.

This paper presents a multi-scalar framework as a complementary tool to yield nuanced insights. The conceptual framework was developed, but needs further case-study testing. The city of Oradea, Romania, will serve as a pilot case, with particular emphasis on the socialist period. The conceptual framework consists of three stages: historical-descriptive, analytical, and interpretative. Tracing the theoretical fields and key authors, the framework aims to be inclusive and suitable for multi-scalar analyses.

Applied to Oradea, Romania, the analysis begins at the macro-scale with a historio-geographical methodology, using contrasting theories (Conzen and Kostof) in order to trace evolutionary stages. The identification of the current fragments of the city is a fundamental part of understanding the fringe belts. At the meso-scale, neighbourhoods and urban fragments are examined by introducing space-syntax methodology. Further research should be conducted at the micro-scale to understand the details of the city.

The first step aims to understand the city as a whole and its historical context. The meso-scale analysis reveals the relationships among different parts of the city; and, as for the post-socialist city, it reveals the relations among *raions* and *micro-raions* within the city and their morphological, spatial, and visual relationships. Therefore, we argue that the framework offers a practical tool for urban planners seeking to understand the spatial logic of urban change and development.



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sciforum-172200: Vertical Vacancy and Spatial Continuity: Evaluating the impact of Visibility and Pedestrian Connectivity on Commercial Building Occupation in Kigali city, Rwanda

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Cities in Africa are undergoing rapid urbanisation to cope with an influx of people majorly seeking better jobs and amenities. Kigali city in Rwanda has evolved rapidly over the past two decades, becoming a hotspot for commerce, finance, and government services. As investment and construction surged, several modern office buildings and commercial spaces have been developed to augment the increasing demand. However, this rapid growth has also led to business concentration in some areas, while other buildings remain vacant, especially on upper floors. This study evaluates how visibility and occupation patterns on lower ground floors influence vacancy in upper floors of commercial buildings in Kigali City, while examining disruptions and spatial relationships between pedestrian crossings and transition stations. Using spatial analysis and architectural assessment, the research investigates how limited visibility, poor vertical circulation, and fragmented pedestrian connections reduce accessibility to upper levels, contributing to their underutilization. Digital platforms such as ArcGIS, Revit, and Lumion were utilised to locate and design key points for these connections. Findings indicate that lower-floor dominance in activity and visibility creates uneven spatial engagement, while discontinuities in pedestrian routes further limit access to elevated spaces. The research highlights the importance of integrated circulation systems, improved visual connectivity, and pedestrian-oriented linkages to support balanced occupation across building levels. These strategies aim to enhance accessibility, reactivate vacant upper floors, and strengthen spatial continuity, contributing to a more efficient and adaptive urban commercial environment.



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Session 2. Urban Environments and Sustainability

sciforum-147191: Beyond Concrete: Reviving Urban Canals and Ecosystems for Climate-Resilient Futures

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Unplanned urbanization in South Asia has accelerated the loss of natural ecosystems, creating new vulnerabilities to climate change. In Sylhet, Bangladesh, the filling and encroachment of canals, combined with poor waste management, have severely disrupted ecological functions. Once vital for drainage, biodiversity, and community livelihoods, urban canals are now sites of pollution, stagnation, and flood risk. This study investigates the ecological and social dimensions of canal degradation while exploring community-driven approaches to ecosystem restoration and climate resilience. A mixed-methods approach was applied, combining GIS-based land-use analysis with household surveys (n = 200) and stakeholder interviews. Findings show that the disappearance of interconnected water channels has intensified flooding, reduced groundwater recharge, and undermined urban biodiversity. Marginalized communities, often residing near these degraded canals, face disproportionate impacts, including health risks and loss of income opportunities. However, local adaptation practices such as participatory canal cleaning, urban gardening, and small-scale waste recycling demonstrate promising pathways for ecological regeneration and social empowerment. The study argues that canal restoration is not merely an environmental issue but also a governance and justice concern, requiring collaboration between residents, municipal authorities, and civil society. Strengthening environmental literacy, integrating digital monitoring tools, and embedding community participation in urban planning can help restore ecological services while fostering equitable resilience. By situating Sylhet within broader debates on climate adaptation and circular urban economies, this research underscores the urgent need to move “beyond concrete” and reimagine cities as living systems where ecosystems and people thrive together.



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sciforum-175929: From Area-Based Greening to Morphology-Based Cooling: Rethinking Urban Heat Mitigation in Global South Megacities

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Urban heat stress increasingly threatens environmental sustainability in rapidly growing megacities. Despite their widespread promotion as nature-based solutions, the cooling performance of blue-green spaces (BGS) heavily relies on their spatial structure and scale. This study examines how the morphological characteristics of BGS influence urban thermal patterns in Delhi. Using satellite-derived land surface temperatures and land cover classifications, patch-level thermal behaviour was analysed across different urban surface types. Spectral indices and spatial metrics were integrated with machine-learning modelling to identify the dominant drivers of cooling and warming dynamics. The findings reveal that urban thermal behaviour is strongly governed by spatial configuration rather than mere green cover. Impervious and exposed surfaces intensify heat accumulation as their spatial dominance increases. However, cooling effects strengthen when blue-green spaces become larger, more continuous, and structurally connected. Water bodies and dense vegetation demonstrate the most stable cooling performance, while fragmented or small patches provide limited thermal relief. Machine-learning interpretation highlights moisture availability and vegetation condition as key regulators of cooling intensity. The results indicate that cooling benefits emerge only when blue-green spaces surpass critical spatial thresholds and maintain morphological integrity. The study demonstrates that sustainable heat mitigation in megacities requires a shift from area-based greening targets toward morphology-sensitive spatial planning. Embedding connected and scale-appropriate blue-green infrastructure within urban form is essential for enhancing long-term environmental sustainability.



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sciforum-175946: The Legal Invisibility of Visual Pollution in Poland: A Systemic Gap in Urban Environmental Protection

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Introduction

Research in neurobiology and environmental psychology indicates that excessive visual stimuli in urban environments may contribute to mental fatigue, reduced attention, and increased physiological stress. Visual pollution (VP) is defined as spatial configurations that generate perceptual overload and negatively affect mental health and quality of life. Despite growing scientific evidence, VP is still framed primarily as an aesthetic rather than a public health issue. In Poland, the phenomenon remains legally undefined and institutionally marginalised.

Methods

This study applies a doctrinal legal analysis combined with a review of interdisciplinary literature on VP and its physiological impacts. Polish environmental law was examined to determine whether the statutory definition of “pollution” could encompass VP. The regulatory potential of planning instruments, including local spatial development plans, landscape resolutions, and landscape audits, was analysed. The capacity of Environmental Impact Assessment (EIA) and Strategic Environmental Assessment (SEA) procedures to address visual impacts was also evaluated.

Results

The statutory definition of pollution in Polish law is limited to “emissions” harmful to health or the environment. As VP refers to spatial configurations rather than emissions, the current framework is inapplicable. Local plans have restricted competence regarding advertising structures, landscape resolutions are optional and legally ambiguous, and landscape audits are strategic and non-binding while VP manifests locally. Neither SEA nor EIA provides established methodologies for visual impact assessment. Consequently, VP lacks measurable thresholds, monitoring mechanisms, and mitigation obligations comparable to those governing other forms of pollution.

Conclusions

The absence of a legal definition results in VP's regulatory invisibility. Recognising it as an environmental health issue is necessary to develop effective instruments to reduce spatial degradation affecting public health in Polish cities.



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sciforum-149266: CHROMIUM IN URBAN AND PERI-URBAN ENVIRONMENTS: MUSHROOMS AND SOIL AS BIOMONITORING TOOLS IN LEICESTERSHIRE, ENGLAND.

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Human exposure to chromium (Cr) via inhalation, ingestion, or dermal contact may pose toxicological concerns. This study assessed Cr levels in 850 surface soil samples and 106 wild mushrooms collected across Leicestershire, including the city of Leicester (England). ICP-MS analysis revealed Cr in 92.2% of 850 surface soil samples (median: 71.3 µg/g) and in 47.1% of 106 mushroom samples (median: 0.863 µg/g dw), with significantly higher values in urban areas, particularly in the southeast quadrant. Health risk assessments calculated for adults and children revealed that total hazard indices (HI) for Cr exposure through ingestion, dermal absorption, and inhalation were below 1 across all scenarios, indicating no immediate risk. Nevertheless, ingestion contributed the highest proportion of exposure (>75%), particularly in young children. Bioconcentration factors (BCFs) were calculated to assess Cr accumulation in fungi, revealing values well below 1, indicating low bioaccumulation potential. The findings suggest that while wild mushrooms reflect local soil contamination, they are not strong accumulators of chromium. This dual-matrix biomonitoring approach combining soils and fungi presents a valuable tool for mapping environmental contamination and identifying urban pollution hotspots. While estimated exposure values fall within acceptable thresholds, the absence of Cr(VI) speciation introduces uncertainty, underscoring the need for further research into its potential carcinogenicity. The findings underscore the importance of integrating environmental biomonitoring with risk communication strategies, particularly concerning mushroom foraging and urban gardening. This study supports continued environmental health surveillance in UK cities and the development of targeted public health interventions.



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sciforum-172305: A Structure-Constrained Analytical Framework for Multi-Variable Urban Planning Questions: A Parcel-Scale Study of Singapore

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Introduction

Urban residential systems involve tightly interrelated variables, including parcel morphology, energy consumption, facility distribution, and transit accessibility. When these indicators change together, outcomes may reflect structural interactions rather than simple one-to-one effects. This study proposes a structured framework that clarifies these relationships and limits interpretation to verified results.

Methods

A relational data model integrates parcel attributes, building energy intensity, public transit nodes, and multiple facility types. Network-based shortest-path distances measure accessibility. Parcels are linked in a knowledge graph when they share nearest-facility or network-path relationships. The graph functions as a structured evidence layer, enabling traceable queries for each planning question. The framework examines functional dependencies, compares high-low groups, and evaluates scaling patterns. All validated findings are stored as graph-based evidence. Under graph-grounded constraints, the LLM interprets results stepwise using only retrieved and verified evidence.

Results

To evaluate the framework, we apply it to two analytical questions in the Singapore public housing parcel.

First, although social services such as childcare achieve full coverage, road-network-based nearest-facility analysis reveals that many parcels share the same service node. By jointly examining building scale and the distance to alternative facilities, the framework identifies parcels with highly concentrated service dependency, locating areas of highest fragility beyond simple coverage metrics.

Second, transit accessibility appears positively associated with energy use. However, validation confirms that energy strictly follows $\text{Energy} = 46.47 \times \text{GFA}$, meaning consumption is fully determined by gross floor area. High-transit parcels also have a higher average GFA, which explains the correlation. After controlling for GFA, the relationship disappears, revealing a density-mediated pathway (Transit $\rightarrow$ GFA $\rightarrow$ Energy) and rejecting a direct causal interpretation.

Conclusions

This framework integrates relational modeling, knowledge graphs, and graph-grounded LLM reasoning to provide a reproducible diagnostic method for parcel-scale urban planning.



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sciforum-165425: A Systematic Review on the Effect of Urbanization on the Microbiome of Urban Blue Spaces

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Urbanization activities, such as eutrophication, pollution and runoff, lead to changes by negatively impacting and reducing the diversity of the microbiome. Urban blue spaces are an integral part of cities; several communities depend on urban water bodies for their livelihood and survival and are heavily affected by rapid urbanization. They play a crucial role in maintaining both human and ecological health at the population level. Quantifying these changes is important for sustainable urban planning.

Using extensive keywords targeting urban blue spaces, such as microbiome and urbanization, we retrieved 1060 papers from two databases and one search engine based on our inclusion criteria of primary data sources for microbiome of aquatic freshwater bodies. Out of 1060, we identified 105 eligible papers after multiple screening rounds. We analyzed these manuscripts from 2000 to 2025 that examined changes in the functional traits, such as antimicrobial resistance (AMR) and nitrogen cycling of the microbiome. Data were extracted by a thematic analysis followed by a narrative synthesis on specific functional traits. This systematic review presents a comprehensive analysis of the changes and challenges caused by urbanization.

Our results indicate that urbanization leads to reduced bacterial diversity of urban water bodies, specifically an increase in Proteobacteria, Cyanobacteria and Coliform bacteria. A significant increase in AMR genes in the water bodies increases the risk of infection by a resistant pathogen.

Microbiome studies on water bodies are indicators for the extent of spread of AMR among pathogens, animals, and humans. The release of antimicrobial compounds into water bodies acts as a driving force for microbial resistance and leads to the emergence of resistant pathogens. Understanding changes in the microbiome is crucial to various blue space functions such as nutrient cycling, organic matter decomposition, and water purification. These insights help inform public health strategies and sustainable urban planning.



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sciforum-163749: An Advanced Analytical Approach for Landfill Site Selection in Rajshahi City for Solid Waste Management

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Municipal solid waste (MSW) management has become a critical challenge in rapidly urbanizing regions, particularly in developing countries such as Bangladesh, where increasing population density and limited land availability intensify the pressure on existing waste disposal systems. In this context, selecting an environmentally sustainable and operationally efficient landfill site is essential for improving long-term waste management strategies. This study proposes a comprehensive decision-support framework for the strategic selection of landfill sites within the Rajshahi City Corporation (RCC) area. The framework integrates two core methodologies: a Genetic Algorithm (GA) and a Random Forest (RF) regression model. The genetic algorithm is employed to optimize site suitability by evaluating key criteria such as distance from Secondary Transfer Stations (STS), available land capacity, accessibility, and transportation considerations. A specially designed fitness function is incorporated into the GA to identify the most optimal site from a set of potential locations. To enhance reliability and provide cross-validation of the GA results, a Random Forest regression model is used to analyze feature importance and assess the influence of each parameter on the final site selection outcome. The RF results confirm that transport cost, distance from STS, and landfill capacity are among the most influential factors in determining site suitability. Based on the integrated analysis, the Baya-Duary region emerges as the most favorable landfill site, exhibiting strong environmental compatibility, adequate land availability, and high operational feasibility. The proposed framework demonstrates a robust and data-driven approach that can support urban planners and policymakers in making informed and sustainable MSW disposal decisions.



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sciforum-168224: Cement mortars with the addition of ash from municipal waste incineration as part of the circular economy

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Nowadays, more and more municipal waste is being generated. One of the reasons for this is the growing number of products purchased and thus the production of municipal waste. The growing amount of waste causes problems with its processing. One way of disposing of waste is its thermal conversion in municipal waste incinerators. This process produces by-products such as ash from municipal waste incineration. The management of these products is problematic due to their toxicity. One way of managing them is to add these by-products to cement mortars and concretes. The ash used in this study was obtained from the incineration of municipal waste in Poznań. Cement mortars were made using CEM I, quartz sand, and ash from municipal waste incineration. Ash was added to the mortar in amounts of 5, 10, 15, 20, and 25% of the cement weight. Samples with appropriate amounts of ash and reference samples were prepared. The basic properties of the mortar, such as density, consistency, flexural and compressive strength after 28 days, and water absorption, were evaluated. The analysis showed that an increase in compressive strength was observed for mortars containing 5, 10, 15, and 20% ash by weight of cement. In the case of flexural strength, an increase was observed only for the 5% ash content. The results for the density of hardened mortar are similar to those for compressive strength. In summary, adding waste incineration ash to municipal waste can have a positive effect on the strength properties of mortars. However, research should be expanded to include an analysis of the toxicity of mortars and an examination of their chemical composition (heavy metal content and oxide composition).



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sciforum-175746: City Birds: Negotiating with Pigeons, Sparrows, Seagulls, Vultures, Northern Cardinals, Oriental Pied Hornbills, and Other Avian Urban Dwellers

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This paper examines how a city's relationship with birds reflects its evolving identity. It analyzes the anti-pigeon campaigns in London, England, Berlin, and Venice; the relationship between Delhi and sparrows and vultures; the cultural history of Istanbul's seagulls; Singapore's Hornbill rejuvenation success story; and Canada's Bird-Friendly City Certification initiative, using London, Ontario, as an example. When do city managers focus on birds? When do the birds draw attention to themselves? When CDO citizens lobby for or against birds? When does the UN declare a bird-friendly decade? When are there avian flu outbreaks? Are birds just symbols of broader urban revisionings—collateral damage or untargeted recipients of protection? It compares the rhetoric and imagery used by cities to officially clarify their “bird” positionings. Does a city's campaign against resident birds necessarily mean a campaign against all birds? Can a city be migrating bird-friendly and openly curb resident bird populations at the same time? It analyzes the different ways public health arguments are used both for and against urban birds, as well as how unwanted birds often symbolize changing relationships with tourists. It concludes by positing general lessons that the bird negotiations in London, England; London, Ontario; Berlin; Singapore; Delhi; Venice; and Istanbul can teach cities aiming to become more sustainable and biophilic.



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sciforum-175955: Evaluating Vegetation and Surface Treatments for Urban Heat Island Mitigation in Hot Desert Campuses: A Microclimatic Study of Najran University

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Urban Heat Islands (UHIs) intensify thermal stress in rapidly expanding campuses across hot desert regions, yet empirical micro-scale data from Saudi university environments remain limited. This study investigates the cooling performance of green spaces and surface treatments at Najran University, located in the arid southern region of Saudi Arabia. To enhance the reliability of satellite-derived land surface temperature analysis and support microclimate simulation inputs, field measurements were undertaken under existing campus conditions. Environmental sensors and handheld instruments were deployed at selected sites representing diverse surface types, including conventional paved areas, reflective-coated pavements, cemented zones, and shaded vegetated areas. Temperature and humidity sensors were elevated to ensure unobstructed ambient data capture, while infrared thermometers recorded surface temperatures through targeted spot readings. Data loggers continuously collected ambient temperature and relative humidity during representative daytime periods. The results demonstrate clear thermal gradients across the assessed surface categories. Vegetated zones exhibited the lowest temperatures, ranging from 6.5 °C in the morning to 29.1 °C at noon, attributable to shading and evapotranspiration. Unpainted pavements showed the highest heat retention, with temperatures between 9.5 °C and 42.7 °C, whereas reflective-painted pavements consistently reduced surface temperatures relative to untreated surfaces.

Spatial analysis further confirmed an inverse relationship between vegetation density and surface temperature distribution across the campus. Overall, the findings highlight that the strategic expansion of green infrastructure, combined with the targeted application of reflective materials, can significantly mitigate localized UHI intensity in arid institutional settings. Such measures support climate-sensitive campus design and advance broader sustainability objectives.



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sciforum-172177: Revitalizing Gisenyi Lakeside Approaching sustainable Development

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The Rwandan city of Gisenyi, located near the northern shoreline of Lake Kivu within the Rubavu District, represents a crucial geographical location with strong strategic value. Gisenyi has a border position with the Democratic Republic of the Congo (DRC), making it a great trade interface between the two countries. Gisenyi has numerous potential, both natural and economic, whereas the town has been bogged down by poor urban planning, poor infrastructure, and exposure to environmental hazards. This research work addresses issues related to the underutilized lakeside architecture of Gisenyi, such as unused buffer zones, limited pedestrian access to the site, and insufficient places to gather in a small-scale economy. The research aims to make recommendations for long-term sustainability policies in architecture that will revamp the lakeside region by improving its ecological guardianship, supporting tourism, and reinforcing its urban character. It employs a mixed-methods approach to compare case studies of waterfront developments in Toronto, Manhattan, and Zurich; observed through mixed-methods analysis, spatial observations, and GIS mapping, as well as interviews with stakeholders. The research concluded that evidence-based, locally sensitive architectural interventions that the community participates in and policy synchronization are key to transforming the lakeside of Gisenyi into a lively, robust, and economically resplendent city.



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sciforum-172714: Urban Breathing Systems: A Spatial Assessment of Green–Recreational Spaces as Health Acupuncture for Physical and Mental Well-Being in Chennai City, a Global South Metropolis

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Rapid urbanisation in Global South cities has led to a progressive decline in accessible green and recreational spaces, resulting in increased environmental stress, lifestyle disorders, and deteriorating mental well-being. In metropolitan cities such as Chennai, rising temperatures, high-density development, and uneven distribution of public open spaces have intensified health vulnerabilities at the neighbourhood level. This study conceptualises urban green–recreational spaces as *Urban Breathing Systems* and examines their role as micro-scale *health acupuncture* interventions in promoting physical and mental well-being. Using Chennai City as a representative case of Global South urbanisation, the study adopts a mixed-methods and spatial analytical approach by integrating high-resolution satellite data, GIS-based accessibility measures, neighbourhood surveys, and secondary health records to construct composite indicators of green exposure, thermal comfort, recreational accessibility, and perceived well-being. Structural Equation Modelling (SEM) was employed to analyse the direct and indirect relationships between green–recreational infrastructure, environmental mediators, and health outcomes, supported by spatial regression and hotspot analyses to identify health-risk and green-deficit zones. The results reveal a statistically significant positive association between green recreational accessibility and both physical activity levels and psychological well-being, with thermal regulation and environmental comfort emerging as key mediating variables. Neighbourhoods with limited access to urban breathing systems exhibited higher stress levels and greater heat-related vulnerability. The study demonstrates that strategically distributed micro green–recreational interventions can function as effective urban health acupuncture in dense metropolitan contexts and provides an evidence-based framework for integrating health-sensitive green infrastructure into urban planning policies to support sustainable and resilient urban development in the Global South.



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sciforum-172790: Urban Lichen Diversity Reflecting Air Quality Patterns across European Cities

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Air pollution represents a persistent ecological pressure in urban environments, influencing biodiversity and ecosystem functioning. Instrumental monitoring networks provide quantitative pollutant measurements but often lack fine spatial resolution and ecological integration. Epiphytic lichens are widely recognized as sensitive bioindicators of atmospheric quality due to their direct absorption of airborne substances and differential tolerance to contaminants. This study comparatively examines documented lichen diversity patterns across multiple European urban contexts, focusing on community variation along gradients of traffic intensity, urban density, and green infrastructure presence. Reported ecological indices, including species richness and atmospheric purity indicators, were evaluated in relation to environmental variables such as vehicular emissions, vegetation continuity, and urban morphology. Recurrent patterns were identified across urban areas. High-traffic zones consistently supported simplified communities dominated by pollution-tolerant crustose taxa, whereas residential and peri-urban green spaces maintained higher diversity including foliose and fruticose species sensitive to air contamination. Vegetated corridors and structurally complex green areas showed a mitigating effect, allowing greater species persistence even near emission sources. The convergence of biological responses across different geographic contexts demonstrates the robustness of lichen diversity as an indicator of urban air quality. Biological monitoring therefore represents a valuable complementary tool for spatial environmental assessment and supports its integration into sustainable urban planning and ecosystem management strategies.



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sciforum-169482: Urban microclimatic influence on flowering phenology and floral traits of *Chaenomeles x superba* 'Pink Lady'

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Urban microclimatic heterogeneity shapes plant phenology, morphology, and reproductive expression, relevant for planning and management of sustainable urban green spaces. This study examines how contrasting urban settings influence flowering dynamics and floral morphological traits of *Chaenomeles x superba* 'Pink Lady' in Novi Sad (Serbia). This research was conducted from 1 January to 8 April 2025 across a representative street and a park environment, differing in degrees of thermal exposure, solar radiation, and environmental buffering typical of urban landscapes. Flowering phenology was monitored through field observations using the BBCH scale, recording the beginning of flowering (BBCH 60; more than 10% of flowers open), full flowering (BBCH 65; more than 50% of flowers open), and the end of flowering (BBCH 69; more than 80% of flowers faded). Monitoring was conducted every second day until the beginning of flowering and daily until the end of flowering. Floral morphology was assessed during peak flowering by analyzing 50 flowers from each analyzed individual. Measurements included sepal and petal length, flower diameter, number of petals, stamens and pistils, and the number of fertile carpels. Data were analyzed using descriptive statistics and comparative statistical tests. The results reveal clear differences in flowering dynamics between urban contexts (street-like and park-like settings). Flowers in more exposed urban areas exhibited an earlier onset of flowering, a faster progression to full bloom, and a shorter overall flowering period, whereas plants in buffered green environments showed prolonged flowering and more gradual phenological transitions. Floral morphological traits also varied between environments, with flowers in park-like settings displaying larger dimensions and more pronounced floral organs, while several traits remained consistent across settings. This study demonstrates that urban microclimatic conditions strongly shape flowering dynamics and reproductive traits of ornamental plants, emphasizing the importance of microclimate-sensitive species selection for sustainable and resilient urban green spaces.



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sciforum-171962: Waterfront 4.0: Landscape and Coastal Regeneration

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Introduction Coastal areas are complex territorial systems where natural processes and anthropogenic pressures interact, producing landscapes that are vulnerable yet culturally important. These areas are among the most exposed to climate change impacts while remaining attractive for tourism and urban development. This dual condition calls for resilient and adaptive planning approaches. This study examines opportunities and challenges in the sustainable management of coastal territories, focusing on urban waterfronts and innovative spatial planning processes. Central to the analysis is the integration of Nature-Based Solutions (NBSs) as tools for climate adaptation, environmental mitigation, and landscape regeneration within a “Waterfront 4.0” framework combining ecological and digital innovation, participatory governance, and smart resource management.

Methods A multidisciplinary approach was employed, integrating historical-geographical analysis with ecological assessment through the use of spatial and multispectral analytical tools. Coastal settlement morphology and evolution were examined diachronically to identify structural vulnerabilities and risk-management gaps. A case study of the Portici waterfront (Naples, Italy) was conducted to assess how NBS can be embedded in regeneration strategies. Planning documents, interventions, and spatial transformations were analyzed to evaluate their environmental and socio-territorial impacts.

Results Contemporary waterfronts function as laboratories for integrated urban and ecological regeneration. NBSs—including dune restoration, vegetated buffers, artificial wetlands, permeable surfaces, and green corridors—enhance resilience to hazards, support biodiversity, mitigate runoff, and improve microclimate regulation. In Portici, the *Parco a Mare* and Pietrarsa dock redevelopment demonstrate how recreational infrastructure and ecological restoration can be integrated. These interventions promote ecological connectivity and landscape enhancement, improve public-space quality, and reinforce the cultural identity of the coastline shaped by the Miglio d'Oro and eighteenth-century Vesuvian villas.

Conclusions The “Waterfront 4.0” approach shows that resilient urban waterfronts can reconcile environmental mitigation, landscape valorization, and sustainable tourism. Data-driven, participatory strategies are essential to ensuring long-term ecological functionality, climate resilience, and balanced socio-economic development in coastal territories.



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sciforum-175979: A Generative Machine Learning Surrogate Model for High-Fidelity Urban Wind Field Prediction

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Accurate prediction of urban wind fields is critical for applications such as Unmanned Aerial System (UAS) trajectory planning, pedestrian comfort analysis, and urban heat island mitigation. However, traditional high-fidelity Computational Fluid Dynamics (CFD) simulations are computationally prohibitive for extensive parametric analyses, while low-fidelity empirical models lack the necessary localized accuracy within complex urban morphologies.

This work presents the development of a Machine Learning Surrogate Model designed to bridge the gap between low-fidelity approximations and high-fidelity simulations. Using generative diffusion architectures, the proposed data-driven surrogate serves as a lightweight, data-fusion-capable tool for rapid wind-flow prediction. The model is trained on a comprehensive dataset generated through parametric simulations of a cityscape, combining high-fidelity solvers with low-fidelity kinematic approximations. The training space systematically covers the range of wind magnitudes and directions derived from annual observed wind roses.

To ensure broad applicability, the surrogate model is designed to generalize across varying building densities, enabling accurate interpolation of flow fields transitioning from dense, high-rise downtown centers to sparse suburban layouts. Furthermore, the model aims to incorporate a robust data-fusion methodology to assimilate sparse, real-world meteorological measurements, dynamically enhancing predictive accuracy.

Ultimately, this generative framework demonstrates substantial downstream utility, offering near-high-fidelity accuracy at a fraction of the computational cost, thereby enabling rapid, reliable environmental modeling for advanced urban infrastructure and autonomous aerial navigation.



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sciforum-172625: Anthropogenic Amplification of Heat Waves Across CONUS: Detection, Attribution, and Urban Implications

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Temperature extremes, heatwaves, and cold snaps pose significant risks to urban infrastructure, public health, economic productivity, and energy systems, making it essential for cities to understand the drivers of these events for effective planning and preparedness. This study quantifies changes in temperature extremes across the Continental United States (CONUS) and examines the relative roles of various climate forcing factors, including greenhouse gas concentrations, land-use change, and natural variability, with particular attention to implications for growing urban areas. Daily maximum and minimum near-surface air temperatures from the Community Earth System Model were analyzed under three forcing scenarios: natural-only, greenhouse-gas-only, and all-forcings combined. Heat waves were defined as six or more consecutive days exceeding the 99th percentile of daily maximum temperature; cold snaps were analogously identified using the 1st percentile of daily minimum temperature. Trend analysis was applied at both CONUS and gridcell scales, and an optimal fingerprinting regression framework was employed for formal detection and attribution. Preliminary results indicate that under all-forcings, extreme hot days increased significantly (slope: 105.45 days/year, $p < 0.001$) and heat wave frequency rose by 5.02 waves/year ($p < 0.001$), while cold days exhibited a non-significant declining trend. The attribution scaling factor of 3.51 suggests that combined forcings amplify heat wave occurrence roughly 3.5-fold relative to natural variability alone. Spatially, the Southwest, West, and Florida showed the strongest intensification, overlapping with regions of rapid population growth; gridcell analysis of the 15 most populated cities confirmed increasing heat wave trends in most urban areas. Building on these single-hazard, single-model results, the next phase of this work will extend the framework to CMIP5 and CMIP6 multi-model ensembles and to compound drought-heatwave events, using a daily-scale bivariate SPI-SHI approach, in order to more robustly attribute changes in compound extremes and better characterize urban vulnerability in a warming climate.



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sciforum-137143: Application of renewable energies in buildings with complex topologies

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The application of renewable energy in buildings, particularly solar radiation (e.g., passive thermal solutions), supports more energy-sustainable city development by enabling buildings with lower energy consumption. This work will analyse the influence of external environmental variables, such as air temperature, air relative humidity, air velocity, carbon dioxide concentration, solar radiation, and other factors, on the assessment of comfort levels, namely the thermal comfort and indoor air quality that the occupants are subjected to in city buildings, using renewable energies.

The work will be developed numerically, using numerical software that simulates the thermal response of buildings. The building, equipped with internal greenhouses, will be analysed. The study examines the evolution of air temperature, building surface temperatures, air relative humidity, air velocity, carbon dioxide concentration, and direct and diffuse solar radiation in outdoor and indoor environments throughout the day. The level of thermal comfort will be assessed using the PMV index. The level of indoor air quality will be evaluated based on the carbon dioxide concentration to which occupants are subjected. The study was conducted in winter conditions and in a Mediterranean environment.

The internal greenhouse, for example, with its hall entrance or covered walkways, is protected by glass facing east, west, and mainly south. The greenhouse stores energy inside the buildings. This energy is transported to cold spaces, such as interior spaces or those facing north, to improve thermal comfort. The renewable airflow rate during transport from the greenhouse to the cold spaces ensures acceptable indoor air quality in both spaces.

The results indicate that the south-facing spaces, equipped with internal greenhouses, are thermally comfortable, and the airflow rate transported to the north-facing spaces, used as cold spaces, also ensures thermal comfort. The proposed solution ensures an airflow rate that guarantees good indoor air quality conditions in all spaces.



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sciforum-172229: Assessment of the impact of air temperature variations on the duration and abundance of flowering of *Abelia × grandiflora* ‘Little Richard’ in the context of urban planning and design

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Variations in temperature have the potential to either enhance or disrupt ecological systems, yet little is known about how the plasticity of Glossy Abelia, under conditions of localised climate change, can facilitate urban planning and design. Therefore, this study focuses on changes in the duration and abundance of flowering of *Abelia × grandiflora* ‘Little Richard’ in Lep Izgled Park in Belgrade during the period 2023–2025. Observations were carried out using the extended BBCH scale, with recorded dates converted into day-of-year values. The accumulated heat sum for flowering onset, full flowering, and end of flowering was determined based on daily maximum and minimum air temperatures. Flowering abundance was evaluated using a 0–5 scale, where 0 indicates the absence of flowering and 5 indicates maximum flowering. The study employed descriptive statistics, the Spearman rank test, the Mann–Kendall trend test in conjunction with Sen's slope test, and regression analysis. The results confirm that air temperature influences both the duration and abundance of flowering. The year factor proved to be significant, with 2024, identified as the globally warmest year, exhibiting the longest flowering phenophase, while flowering abundance varied depending on daily maximum and minimum air temperatures. The distribution of flowering abundance and shifts in phenological patterns suggest that the responses of Glossy Abelia represent adaptations to local conditions. This study also provides a framework for modelling the potential effects of temperature changes on the dynamics and abundance of flowering on both local and global scales. The research highlights key events in flowering patterns in order to emphasise the influence of air temperature on changes in the urban phenology of glossy abelia, with the aim of supporting the operationalisation of urban planning and park design.



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sciforum-175926: ASSESSMENT OF TRAFFIC NOISE POLLUTION IN THE URBAN ENVIRONMENT IN KERALA, INDIA

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The rapid increase in traffic, vehicles, urbanization, and population has led to traffic noise pollution. The World Health Organization (2011) reported that more than one million people suffer from health problems every year due to traffic noise pollution. Hence, the current study is conducted to determine the level of traffic noise pollution in the silence zone of Malappuram Municipality, Kerala. For this study, one week of data was taken from morning (8am to 9am), afternoon (1pm to 2pm), and evening (5pm to 6pm) during the period between 28th July and 3rd August 2023. Continuous data for 1 hour from each session were collected at 5-minute intervals. The average maximum (Lmax) and minimum (Lmin) noise levels were expressed in decibel units, and the data were compared with the Central Pollution Control Board's (CPCB) ambient noise requirements notified under the Noise Pollution (Regulation and Control) Rules, 2000. Besides, the total number of vehicles passing in a unit of time (one-hour period) from each session was counted and recorded. Results showed that the highest average noise level (85.2 dB) was recorded on Friday evening, and the lowest average noise level (65.5 dB) on Sunday morning. Both obtained values are higher than the permissible limit (50 dB) of the silence zone during the daytime by CPCB. Besides, the highest number of vehicles (3689) passed through the study area on Wednesday evening, while the lowest (1871) passed on Friday morning. The major factors governing traffic noise pollution are the air horns of heavy vehicles, such as trucks, buses, and ambulances, moving through the city.



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sciforum-164086: Bluebelts for Urban Sustainability: NYC's Nature-Based Stormwater Resilience

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The New York City Bluebelt program, established in 1991 by the Department of Environmental Protection, represents a pioneering Nature-based Solution (NbS) for urban stormwater management and ecosystem restoration. Spanning over 400 acres of wetlands and 11 miles of stream corridors, the overarching objective is to preserve natural drainage pathways to mitigate flooding, enhance water quality, and bolster biodiversity amid urbanization pressures. This study evaluates the Bluebelt against the ten guiding principles of the United Nations Decade on Ecosystem Restoration (2021-2030), demonstrating strong alignment in advancing Sustainable Development Goals (SDGs) such as 6 (Clean Water), 11 (Sustainable Cities), 13 (Climate Action), 14 (Life Below Water), and 15 (Life on Land). Key practices include wetland preservation, stream restoration, bioremediation, and native plantings, which integrate indigenous, scientific, and local knowledge to address the causes of degradation while delivering multifaceted benefits, such as flood risk reduction, pollution control, and enhanced recreational spaces. Through inclusive governance that involves residents, agencies, and stakeholders, the program employs a restorative continuum—from preservation to adaptive management—with ongoing monitoring to ensure scalability. Economically efficient, it saves millions compared to gray infrastructure, increases property values, and enhances community resilience against climate impacts (viz, rising sea levels and heavier rainfall). This initiative exemplifies urban sustainability by operationalizing global restoration standards locally, offering replicable insights for cities worldwide on holistic planning, policy support, and stakeholder engagement to foster resilient, ecologically vibrant landscapes.



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sciforum-174415: Compounding Socio-Ecological Failure: How Governance Exclusion Converts Community Stewards into Accidental Polluters in the Nairobi River Basin

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Urban river degradation is frequently framed as a technical failure of waste management or infrastructure. This study advances an alternative hypothesis: that governance exclusion itself functions as a structural driver of socio-ecological collapse. Using the Nairobi River Basin as a case, we examine how pollution gradients, ecosystem decline, and disease burden intersect with institutional marginalisation in riverside communities, with implications for SDGs 3, 6, 11, and 13.

A convergent mixed-methods design integrated four datasets covering the period 2018–2024: (1) secondary water quality records across thirteen parameters (BOD, DO, COD, heavy metals, microbial indicators) benchmarked against WHO standards; (2) outpatient morbidity records from health facilities serving Kibera, Mukuru, and Mathare; (3) purposive household interviews (n = 12 most-impacted households identified through community leadership networks); and (4) a multi-stakeholder validation forum involving residents, community leaders, waste operators, and municipal actors. Field observations were conducted from upstream catchment zones, including Ondiri Swamp, to downstream industrial and informal settlement corridors. Pearson correlation was used to test contamination–disease associations. Ethical approval and informed consent were obtained prior to primary data collection.

A pronounced downstream pollution gradient was observed. Peak *E. coli* concentrations reached 100,000 CFU/100 mL ($\approx 800\times$ WHO guideline), while lead exceeded permissible limits by up to $50\times$. *E. coli* levels were strongly associated with cholera incidence ($r = 0.79$, $p = 0.01$). Waterborne diseases accounted for approximately 35% of outpatient visits at Riverside facilities. Ecological assessment documented near-total loss of sensitive aquatic taxa downstream. Qualitative findings revealed high levels of localised ecological knowledge and active stewardship practices; however, residents reported zero formal representation within river governance structures.

Findings suggest that the basin's degradation is not solely a technical deficit but a governance architecture that externalises responsibility while withholding infrastructure and decision-making power. Sustainable recovery requires institutionalising community stewardship within formal river management systems.



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sciforum-172753: Elucidating Urban Heat Island in an Industrial Town/s: A Case Study of Jamshedpur Urban Agglomeration

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Cities experiences higher temperatures compared to surrounding rural regions. The research utilized remote sensing data to analyze spatio-temporal changes in land use and land cover, land surface temperature, Normalized Difference Vegetation Index, and normalized difference built-up index (NDBI) across Jamshedpur Urban Agglomeration over 35 years from 1990 to 2025. The findings revealed a significant increase in built-up areas (237%) and a decrease in vegetation (21%), resulting in rise in average land surface temperature from 22.5°C in 1990 to 30.1°C in 2025. Industrial cores, commercial hubs, and densely populated residential areas were identified as severe UHI zones, with temperatures up to 5°C higher. Commercial areas like Sakchi and Bistupur emerged as localized UHIs, with temperatures up to 3°C higher than surrounding residential areas.

Heating patterns in residential area was influenced by urban morphology, building materials, and green cover. Slum clusters experiences high temperatures (35.5°C) due to high-density, low-rise dwellings with heat-trapping roofing materials, and sparse vegetation. In contrast, planned low-density housing areas like Sakchi recorded relatively lower temperatures (30–31.3°C) due to higher vegetation cover and more permeable surfaces. The research emphasizes the urgent need for interventions to mitigate UHI effects. These include implementing cool roof technologies, expanding green spaces, enhancing ventilation through climate-sensitive urban design, and developing hierarchical networks of green areas at various scales.

The study underscores the importance of incorporating UHI adaptation into urban planning policies to create more livable and climate-resilient cities. The research highlights the necessity of proactively mapping UHIs, conducting granular assessments of localized drivers, and adopting heat-mitigating measures synergistically across building, neighborhood, and city scales. As India's urbanization continues to accelerate, this research exemplifies the necessity of incorporating urban heat island adaptation as a policy priority for fostering livable, climate-resilient cities.



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sciforum-164190: Evaluating the Synergy between Urban Agriculture and Local Resources

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Despite the promise of urban agriculture, there is a lack of understanding in assessing the potential material and energy flows and associated system-level impacts of urban agricultural systems at the city level, which may combine used water with a circular economy. It remains unclear how the choice between different novel approaches such as greenhouse, hydroponics, and aquaponics will affect the technoeconomic feasibility of these systems. In addition, urban planning, investment decisions and resource allocation by decision-makers and stakeholders are done in isolation and lack coordination, and these must be enhanced by an understanding of what an urban community can expect if the urban agriculture systems are to be developed to meet the local food demands sustainably. This research will examine current policy and regulatory gaps for urban regions including the Greater Chicago Metropolitan Area and Northwest Indiana, assess the chemical and thermal potential of used water resources for urban agriculture, and discuss the techno-economic viability of landscape-scale urban agriculture based on greenhouse and hydroponic systems. We will also present various scenarios for cost-effective recovery and reuse of these resources, and these might prioritize one resource over the other or focus on a single resource. For example, the scenarios will include the following: (i) heat over organics; (ii) organics over heat; (iii) nutrients over organics; (iv) water over nutrients, (v) water over energy, and (vi) energy over water.



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sciforum-159424: Evaluating the Urban Acoustic Environment Through Mobile Monitoring: Are Campus Noise Levels Within Safe WHO Standards?

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Introduction

Noise pollution is a public health concern in urban environments. A university campus environment is at high risk of continuous exposure to elevated noise that can impair the concentration, communication, and overall wellbeing of students.

Objective

This study was conducted to measure and record noise levels around the campus at different times of the day (morning, afternoon, and evening) using a mobile application and to compare data with WHO recommended noise exposure limits.

Methodology

This study assessed daytime noise levels across a university campus and adjacent neighborhood using a cross-sectional observational design. Noise measurements were collected at 20 purposively selected locations representing major activity zones, including the main gate, cafeteria, corridors, parking areas, and roadside sections. Data were recorded during the morning (08:00–10:00) and afternoon (13:00–15:00) using a free mobile decibel-meter application. World Health Organization environmental noise assessment guidelines were followed. Each reading was taken from a height of 1.2 meters and at least 1–2 meters away from reflective surfaces. Two short samples per time block were recorded, averaged, and supported with contextual observations.

Results

The results showed that average daytime noise levels ranged from 66.9 to 71.3 dBA, which exceeded the recommended limit of 55 dBA. Afternoon readings were consistently higher across all locations, reflecting increased student activity and vehicular flow. High noise hotspots included the Café, Main Road (Campus Side), and the main gate, where levels frequently exceeded 75–84 dBA. Relatively quieter locations, such as the library exterior and hostel areas, also surpassed WHO thresholds.

Conclusion

The study concluded that the university campus environment was found to be significantly noisier than international safety standards. Targeted noise management strategies in high-activity zones are required to maintain a conducive academic environment. The findings also demonstrate the practicality of mobile-based noise mapping as a low-cost assessment tool for campus environmental monitoring.



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sciforum-172329: Extreme-by-design urban lagoons: functional resilience and trophic reorganization under chronic urban stress

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Urban lagoons are increasingly common features of contemporary cities, frequently created or heavily modified by urban planning and subsequently exposed to chronic anthropogenic stress. Operating far from historical reference conditions, these systems often persist over long periods as novel urban ecosystems. Understanding how ecological functioning is maintained under such conditions is essential for sustainable urban management and resilience planning. We analyzed a highly impacted urban lagoon in Gualeguaychú city, Argentina, using long-term ecological monitoring data (2015–2019), including phytoplankton, zooplankton, benthic macroinvertebrates, fish, and physicochemical variables. Structural (taxonomic) and functional (trait-based) food webs were constructed to evaluate whether ecosystem functioning persists through non-random reorganization rather than structural complexity. Network metrics were compared with degree-preserving null models, and environmental drivers were assessed using correlation analyses and a parsimonious piecewise structural equation model. Results showed pronounced taxonomic simplification and trophic truncation, with communities dominated by pollution-tolerant, benthic-oriented guilds and limited pelagic consumers. Structural networks were simplified and largely indistinguishable from null expectations. In contrast, functional networks exhibited significantly higher modularity, connectance, and redundancy than expected by chance, indicating compensatory organization and energy canalization through detrital, periphytic, and mixotrophic pathways. A minimal physicochemical cascade (Alkalinity → pH → Dissolved Oxygen → Average Trophic Level) revealed the combined role of chemical buffering and functional redundancy in sustaining trophic organization under chronic stress. These findings suggest that urban lagoons may operate as “extreme-by-design” systems, in which persistence arises from constrained yet non-random functional organization rather than from taxonomic richness. From a sustainability perspective, our results support prioritizing functional indicators, such as redundancy, modularity, and basal-resource pathways, over species-based targets when managing chronically disturbed urban aquatic ecosystems.



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sciforum-174954: From Urban Memory to (Un)Sustainable Vegetation Concept

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From prehistoric settlements to modern cities, vegetation has played a central role in human environments as a source of food and medicine, an element of religious rituals, a natural calendar, a protective barrier, a medium for artistic expression, and a source of materials for tools and weapons. Today, it continues to sustain life by addressing ecological challenges and promoting mental well-being by reconnecting humans with nature, which is progressively disappearing in urban landscapes.

Novi Sad, a city in northern Serbia, has a rich urban history, particularly from the Austro-Hungarian era and the reign of Empress Maria Theresa, who promoted public health through well-maintained outdoor spaces featuring lawns, flowers, and rows of fruit trees in front of homes. Nearly three centuries later, the city is heavily built up, with its green legacy surviving only in fragments. Family houses have been replaced by multi-story buildings, greenery by concrete, and urban vegetation has significantly declined, affecting residents' quality of life.

This study examines urban greenery during the urban transformation of the district Podbara in Novi Sad. It questions whether vegetation still exists or the focus has been shifted to minimal coverage. The study aims to assess environmental quality in response to the effects of urban transformation. The methodology included vegetation inventory, tree age assessment, and biodiversity indicators. The applied methodology revealed a considerable loss of vegetation resulting from urbanization. Nevertheless, the persistence of diverse species remnants yielded a satisfactory biodiversity index that does not fully reflect the on-site conditions.

Although the biodiversity index shows a satisfactory environment, vegetation suffers from construction dust, negligence, or removal for building. Nature persists—but can humans thrive without it? Restoring green heritage and reaffirming the human–nature connection is not merely desirable, but imperative in the face of intensive urbanization and increasingly challenging urban living conditions.



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sciforum-161137: Green Space Dynamics in a Rapidly Urbanizing African City: A Spatial and Socio-Economic Study of Wolkite City, Ethiopia

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Rapid urbanization in Wolkite City, Ethiopia, has accelerated population growth and infrastructure development at the expense of green areas. This study quantifies relationships and long-term trends between green spaces and settlements from 1985 to 2024 using remote sensing, GIS-based spatial indicators, and social research. The novelty of this research lies in proposing three original indicators for urban development trends—Green Area Loss Indicator ($LOST_{GREEN}$), Settlement Increase Indicator (SII), and Cumulative Ratio Index (CRI)—explicitly tuned to the socio-spatial conditions of Sub-Saharan African cities, with Wolkite, Ethiopia, as an illustrative case. These indicators track spatiotemporal land-use dynamics, reveal a strong inverse relationship between settlement expansion and green-space extent, and delineate critical zones needing immediate planning action. Household survey results show uneven awareness of green-space benefits across socioeconomic groups; education, occupation, and income predict environmental consciousness. Residents with higher educational attainment and stable employment more frequently recognized the ecological and social value of green areas. By integrating spatial metrics with social evidence, the study derives actionable guidance for urban planning and governance to support sustainable growth in Wolkite. Beyond the case, it offers a replicable assessment framework for fast-growing Sub-Saharan cities and underscores the importance of public awareness and participatory planning to mitigate ecological degradation and balance urban expansion with environmental integrity.



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sciforum-175370: Green Space Dynamics in a Rapidly Urbanizing African City: A Spatial and Socioeconomic Study of Wolkite City, Ethiopia

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Rapid urbanization in Wolkite City, Ethiopia, has accelerated population growth and infrastructure development at the expense of green space. This study quantifies the relationships between green space and settlements from 1985 to 2024 and their long-term trends using remote sensing, GIS-based spatial indicators, and social research. The novelty of this research lies in the proposal of three original indicators for urban development trends—Green Space Loss Indicator (LOST_{GREEN}), Settlement Increase Indicator (SII), and Cumulative Ratio Index (CRI)—explicitly tailored to the socio-spatial conditions of Sub-Saharan African cities, with Wolkite, Ethiopia, as an illustrative case. These indicators track spatiotemporal land-use dynamics, reveal a strong inverse relationship between settlement expansion and green space extent, and delineate critical zones in need of immediate planning action. Household survey results indicate uneven awareness of the benefits of green spaces across socioeconomic groups, with education, occupation, and income predicting environmental consciousness. Residents with higher levels of education and stable employment more frequently recognized the ecological and social value of green spaces. By integrating spatial metrics with social evidence, the study derives actionable guidance for urban planning and governance to support sustainable growth in Wolkite. Beyond this case, it offers a replicable assessment framework for fast-growing Sub-Saharan cities and underscores the importance of public awareness and participatory planning in mitigating ecological degradation and balancing urban expansion with environmental integrity.



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sciforum-172589: Impact of Urbanaization on Green Spaces in Islamabad, Pakistan: A case study of sector D-12

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Rapid urbanization is destroying green spaces at a never-before-seen speed throughout the developing globe, which raises major concerns about public health, climatic resilience, and ecological sustainability. Declining green spaces in planned capitals reflects a weakened foundation of planning principles, not just a loss of environment. The landscapes that were formerly characterized by open areas and green belts are changing due to the rapid urbanization in Islamabad, the capital city of Pakistan. Originally intended to be a "garden city" that balanced natural barriers with constructed infrastructure, Islamabad is currently under increasing strain from land conversion and construction, especially in Sector D-12, close to Margalla Hills. The loss of green space in Sector D-12 is investigated in this study using the theories of urban ecology and sustainable development. It views the industry as a networked urban ecosystem where natural systems are directly impacted by construction operations. Concerns regarding long-term environmental sustainability have been raised by the disruption of biodiversity, changes to natural drainage patterns, and escalation of local heat conditions caused by the replacement of plants with buildings. A qualitative case study and 15 semi-structure KIs were conducted. Findings revealed that open spaces, green belts, and tree covers have significantly decreased, as well as deteriorating environmental comfort, soil erosion during rainfall, and rising temperatures. Although the Capital Development Authority (CDA) has started park development projects and plantation campaigns, these initiatives seem to be primarily reactionary. Conservation measures are hampered by inadequate zoning enforcement, little monitoring, and ongoing development pressures. Islamabad is deviating from its initial ecological objective, this study reveals. Ecological corridors, rooftop gardening projects, more community involvement in environmental monitoring, greater enforcement of regulations, and required green integration in private projects are all necessary for sustainable urban growth.



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sciforum-175975: Integrando naturaleza y patrimonio: indicadores de sostenibilidad ambiental en el paisaje urbano histórico de Cuenca, Ecuador.

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The Historic Urban Landscape (HUL) approach promoted by UNESCO calls for integrating natural and cultural heritage, yet its empirical application in urban planning remains limited, especially in Latin American cities. This study addresses that gap by proposing a multidimensional mathematical model to quantify environmental sustainability in the Ingachaca Urban Action Unit in Cuenca, Ecuador. The area is a transitional landscape combining vernacular architecture, the Tomebamba River riparian corridor, and the Pumapungo archaeological complex.

A Composite Environmental Sustainability Index was developed using the Analytic Hierarchy Process (AHP) based on expert consensus. Seven indicators were standardized on a 0–1 scale using satellite imagery and in situ sensors: soil permeability, green area per capita, vegetation index (NDVI), biological diversity (Shannon Index), water quality (WQI), air quality (settleable dust and combustion gases), and acoustic pollution.

The resulting global index reached 0.593, indicating moderate environmental sustainability while revealing strong ecological polarization. On the positive side, the landscape structure shows high biophysical resilience, supported by 78.15 m² of green space per capita, 71.3% permeable soil, robust vegetation coverage, and acceptable river water quality (WQI = 67.55). These conditions provide a solid ecological base consistent with HUL principles.

However, this potential is significantly undermined by intense external urban pressures. The most critical impacts are extreme acoustic pollution, with average daily noise levels of 118 dB and peaks above 130 dB, and sustained atmospheric degradation driven by heavy vehicular traffic.

The proposed AHP-based model supports strategic planning by integrating Nature-based Solutions (NbS) with heritage conservation. It quantitatively demonstrates how blue-green infrastructure can mitigate environmental stressors while protecting vernacular and archaeological values. Replicable across historic urban centers, the methodology reframes heritage landscapes as resilient socio-ecological systems where ecological restoration and cultural preservation jointly enable sustainable, healthy urban living.



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sciforum-174188: Kuala Lumpur Climate Action Plan Implementation Analytics: Programme Effectiveness, Co-Benefits, and Equity

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The accelerating impacts of climate change in tropical megacities necessitate robust evaluation mechanisms to ensure that urban climate policies deliver measurable, inclusive, and sustainable outcomes. This study proposes a comprehensive implementation analytics framework for the Kuala Lumpur Climate Action Plan (KLCAP) in Kuala Lumpur, focusing on programme effectiveness, socio-environmental co-benefits, and distributive equity. The framework integrates greenhouse gas (GHG) inventories, building energy performance data, public transport usage statistics, urban heat island mapping, flood vulnerability indices, and socio-demographic datasets within a multi-criteria evaluation architecture. Key performance indicators (KPIs) are structured across three domains: (i) mitigation effectiveness (carbon intensity reduction, renewable penetration, energy efficiency gains), (ii) adaptation performance (flood risk reduction, thermal comfort improvement, infrastructure resilience), and (iii) socio-economic co-benefits (public health enhancement, green employment generation, mobility accessibility, and air quality improvements). A spatially weighted Urban Climate Equity Index (UCEI) is introduced to assess whether climate investments equitably benefit low-income and climate-vulnerable communities. Scenario-based modelling compares baseline implementation pathways with equity-optimised resource allocation strategies. Results indicate that embedding equity metrics into programme prioritisation enhances cumulative social welfare benefits while maintaining carbon reduction trajectories. The proposed analytics model provides city planners and policymakers with a transparent, data-driven decision-support system to strengthen accountability, optimise resource allocation, and advance a just and resilient urban transition.



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sciforum-174192: Kuala Lumpur Net Zero Carbon Buildings Roadmap: Compliance Pathways, Costs, and Retrofit Prioritisation

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Achieving carbon neutrality in the building sector is central to Malaysia's urban decarbonisation strategy. This study examines the implementation pathways of the Kuala Lumpur Net Zero Carbon Buildings (NZCB) Roadmap in Kuala Lumpur, focusing on regulatory compliance mechanisms, lifecycle cost implications, and data-driven retrofit prioritisation. The research develops an integrated assessment framework combining building energy benchmarking, operational carbon intensity analysis, embodied carbon accounting, and financial feasibility modelling. Compliance pathways are evaluated across new developments and existing building stock, considering alignment with national energy efficiency regulations, municipal planning guidelines, and green building certification standards. A multi-criteria retrofit prioritisation model is proposed, incorporating energy savings potential, marginal abatement cost (MAC), payback period, occupant comfort improvement, and carbon reduction per square metre. Scenario simulations compare incremental efficiency upgrades, deep energy retrofits, and renewable energy integration strategies under different carbon pricing assumptions. Results indicate that targeted retrofits in high-intensity commercial and mixed-use buildings yield the greatest emissions reductions per unit investment, while bundled measures combining efficiency and on-site solar generation optimise long-term cost performance. The study provides a structured decision-support framework for municipal authorities, property owners, and investors to accelerate NZCB adoption. By aligning compliance requirements with economic feasibility and carbon impact metrics, the proposed approach strengthens policy implementation, enhances transparency, and supports Kuala Lumpur's transition toward a resilient, low-carbon urban built environment.



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sciforum-172765: Mapping unmonitored urban pollution: an ST-GNN and Sentinel-5p fusion for air quality prediction

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India's rapid urbanization has precipitated a severe air quality crisis, yet 47% of the population resides in unmonitored "blind spots". This data deficit hinders the application of GIS and AI, essential for health-supportive urban planning. Because of this spatial sparsity, traditional interpolation methods, such as Kriging or Inverse Distance Weighting (IDW), are ineffective due to their inability to capture non-linear, dynamic atmospheric phenomena.

This research proposes a novel Spatio-temporal Graph Neural Network (ST-GNN) framework designed specifically for the Indian context. The framework integrates sparse ground-based monitoring data with high-resolution satellite imagery from Sentinel-5P TROPOMI and meteorological reanalysis data (ERA5) to predict air quality at a granular local scale. By utilizing an inductive learning approach combined with a Transformer-based temporal attention mechanism, the model functions as a "virtual sensor" network. This allows it to accurately estimate pollution levels in previously unmonitored regions.

This study details the framework's architecture, rigorous data processing, and validation, establishing a new benchmark for scalable, cost-effective air quality management systems. Such innovations are crucial for meeting the objectives of the National Clean Air Programme (NCAP) and protecting public health in expanding urban centers. By bridging the gap between sparse physical sensors and continuous spatial data, this ST-GNN approach provides the high-fidelity insights necessary for data-driven environmental policy and urban design.



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sciforum-175747: Microclimate-Sensitive Urbanism: A Method for Estimating Local Urban Heat Island Effect Impact on Building Energy Performance

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Urban heat islands (UHIs) are a defining challenge of contemporary cities, exacerbating thermal stress and increasing energy demand in the built environment. While UHI research has traditionally focused on quantifying air and surface temperature differences between urban and rural settings, there is limited integration of microclimatic effects into building energy performance, particularly within advanced energy-efficient frameworks such as Passive House and nearly zero-energy building (nZEB) standards. This study proposes an original **Local Urban Heat Island Index (L-UHI)** that operationalizes multiple urban design and landscape parameters—vegetation typologies, water surfaces, shading geometry, surface materials, and anthropogenic activity—to estimate localized thermal elevation relative to a rural baseline. Drawing on novel high-resolution drone thermal data and urban morphology metrics, the L-UHI model aggregates design-driven cooling and warming factors into a composite index that captures site-specific microclimatic impacts.

Beyond proposing a scalable methodology for urban project evaluation, the research advances a quantitative linkage between L-UHI and building energy performance by translating localized temperature amplification into its potential impact on heating and cooling demand. By incorporating L-UHI as a modified boundary condition within building energy assessment frameworks, the study explores how microclimatic intensification may alter annual energy consumption (kWh/m²·year) in high-performance buildings, including Passive House and nZEB standards. Rather than treating urban climate and building efficiency as separate domains, the proposed approach establishes a methodological bridge between urban morphology and energy modeling, enabling the estimation of climate-sensitive performance deviations at the project scale. The framework thus connects urban design decisions with measurable implications for energy demand and thermal stress, contributing to more integrated strategies for climate-adaptive urban development.



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sciforum-173501: Reclaiming Place: Human-Centered Urban Futures through Creative Sustainability

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Urban planning is not merely a technocratic discipline but a socio-anthropological one. This paper advances a framework of creative sustainability to examine how cities can evolve into inclusive, adaptive, and caring ecosystems by integrating ecological intelligence, cultural continuity, participatory governance, ethically grounded digital innovation, blockchain infrastructures, and regulatory sandboxes. Responding to intersecting pressures of climate disruption, digital alienation, algorithmic governance, and widening urban inequality, the study argues that urban transformation must be guided by relational and normative principles rather than instrumental optimization alone. Drawing on Martin Heidegger's philosophy of dwelling and the Greek ethic of synelaxis, the paper critiques technocratic and corporate-driven paradigms of "smart" urbanism and emphasizes the importance of human-centered approaches.

The research employs a conceptual and comparative methodology, synthesizing insights from urban theory, sustainability studies, and digital governance frameworks to develop an integrated analytical model. It proposes combining ecological justice, social sustainability, democratic governance, and adaptive regulatory learning through responsible experimentation with digital infrastructures. Regulatory sandboxes are highlighted as mechanisms that enable cities to pilot innovative solutions safely, while blockchain is positioned as a tool for transparency, accountability, and participatory engagement in urban governance.

This paper contributes a theoretically grounded and policy-relevant model for antifragile, culturally attuned, and human-centered urban futures in which technology supports—rather than displaces—collective care, accountability, and everyday meaning. By bridging normative principles and practical experimentation, the framework offers guidance for cities seeking resilient, inclusive, and ethically responsible pathways toward sustainable urban transformation.



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sciforum-167364: Reframing Urban Ecological Space Toward Systemic Ecological Thinking

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Urban ecological space has become a central concern in contemporary urban discourse, yet it remains approached predominantly through fragmented, function-oriented interventions. Green spaces are commonly framed as discrete amenities or technical infrastructures, rather than as integral components of relational urban ecological systems. This condition reflects not only spatial fragmentation but a deeper conceptual rupture in how urban ecology is understood and sustained. This paper argues that the limitations of prevailing urban ecological practices stem less from insufficient ecological performance than from the absence of systemic ecological thinking. By isolating ecological functions from their relational, perceptual, and socio-cultural contexts, dominant green-space paradigms struggle to support long-term ecological continuity and regeneration. The study advances a conceptual reframing of urban ecological space as a systemic condition rather than a collection of spatial elements. The argument is grounded in the author's doctoral research and informed by long-term spatial observation and interpretive analysis of urban ecological systems. This grounding supports theoretical synthesis rather than empirical generalisation. Building on this foundation, the paper articulates systemic ecological thinking as a conceptual framework through which urban ecological space is understood as relational, continuous, and perceptually mediated. Within this reframing, regenerative aesthetics is proposed as a mediating logic that links ecological processes, lived experience, and social continuity, offering a pathway for understanding ongoing ecological regeneration at the urban scale.



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sciforum-175696: Spatio-temporal urban noise exposure at metro station entrances: a city-scale 24-h study in Shenyang

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Introduction: Metro station entrances are among the most acoustically exposed urban public spaces, where transport, commercial activities, and pedestrian flows converge. Yet large-scale 24-hour noise evidence for these sites remains scarce, and existing studies seldom compare activity, built-environment, and source-composition drivers within the same model or translate findings into station-level intervention priorities. This study investigates spatiotemporal noise patterns, their multi-domain drivers, and governance prioritisation at metro station entrances in Shenyang, China.

Methods: Taking Shenyang, China, as a case study, a one-day 24-hour monitoring programme was conducted at 111 station entrance sites (one entrance per station) during April–September 2025, yielding 109 valid sites. Hourly A-weighted equivalent sound levels (LAeq) were integrated with a population-heat activity proxy, built-environment indicators, and sound-source composition derived from audio event recognition. Five noise outcomes (LAeq_24h, Lday, Lnight, LPeak, LInter-peak) were evaluated using robust OLS with cross-period stability comparison. Governance outputs combined a Baseline–Surplus typology with bootstrap-tagged Top-10 prioritisation.

Results: A clear diurnal rhythm was identified (peak-to-trough difference: 7.61 dB), alongside significant spatial clustering (Moran's I = 0.196–0.246, all p = 0.001). Source composition was the most stable driver domain: traffic share was consistently positive and natural share consistently negative across all five outcomes. The Baseline–Surplus framework differentiated structurally high-burden stations from those with excess noise, and 9 of the Top 10 priority stations showed high bootstrap stability (topk_prob ≥ 0.80).

Conclusions: This study provides city-scale screening evidence for noise exposure at metro station entrances. Source composition, particularly traffic and natural sound shares, offers the most stable diagnostic signal for governance. The Baseline–Surplus typology and bootstrap stability tagging can help managers identify priority stations and allocate resources under uncertainty, rather than relying on uniform exposure ranking alone.



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sciforum-175859: Spatiotemporal assessment of the correlation between surface thermal field variance and human thermal discomfort in Dhaka

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Rapid urbanization in tropical megacities has significantly altered local energy balances, intensifying severe microclimatic degradation. While traditional urban climatology depends on Land Surface Temperature (LST) and the Urban Heat Island (UHI) effect, these physical metrics often fail to detect the true human thermal discomfort experienced by residents. To address this critical gap, this study evaluates the spatiotemporal dynamics of human-centric urban thermal discomfort in Dhaka over a two-decade period from 2005 to 2025. Utilizing the Google Earth Engine (GEE) Python API, this study combines Landsat 5 and 8 optical-thermal data with ERA5-HEAT atmospheric reanalysis. This study uniquely quantifies localized structural degradation through the Urban Thermal Field Variance Index (UTFVI). It applies bilinear spatial interpolation to downscale coarse atmospheric data into high-resolution (30m) Universal Thermal Climate Index (UTCI) gradients, effectively translating surface anomalies into actual heat-health exposure. The findings reveal a rapid deterioration of Dhaka's urban thermal environment. Densely built-up areas saw a dramatic shift in peak LSTs over two decades, climbing from 32°C to over 40°C. At the same time, heat stress for people intensified. By 2025, average temperatures (UTCI) will hit 37.8°C to 38.1°C, putting residents in the 'Strong Heat Stress' category. Data from 500 random locations shows a strong, steady link between extreme environmental heat (UTFVI > 0.15) and the highest levels of physical discomfort. These findings confirm that the localized depletion of permeable surfaces directly forces severe atmospheric heat stress, providing a replicable, dual-index framework to guide targeted microclimatic interventions and climate-resilient urban planning in the Global South.



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sciforum-175750: Strategic Plant Selection as a Bioclimatic Control Mechanism: Evaluating Thermal Comfort Performance in Mediterranean Patio Housing

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This research examines whether the **selection and spatial positioning of plant species**, according to their growth patterns, seasonal behavior, and climatic adaptation, can significantly improve bioclimatic performance and the Thermal Comfort Index in Mediterranean patio housing.

The working hypothesis states that strategically selected vegetation adapted to local climatic conditions and arranged according to solar orientation, vertical development, canopy density, and evapotranspiration capacity produces measurable improvements in thermal stability and indoor comfort when compared to non-optimized planting schemes.

Within the Casa Patio experimental dwelling, promoted by Todobarro in collaboration with the University of Málaga, plant species were selected based on: (1) deciduous or evergreen character for seasonal solar modulation, (2) evapotranspirative potential for passive cooling, (3) morphological growth structure for controlled shading, and (4) drought tolerance to ensure water efficiency under Mediterranean conditions. Vegetation is distributed across perimeter parterres, courtyard spaces, and interior zones to generate differentiated microclimatic effects, including dynamic solar filtering, humidity stabilization, and reduction of diurnal thermal oscillations.

The vegetation system operates synergistically with porous ceramic elements and programmable irrigation, activating evaporative cooling processes that enhance passive temperature regulation. A comprehensive sensor network and on-site meteorological station continuously monitor air and surface temperature, relative humidity, solar radiation, wind variables, and soil moisture, enabling real-time correlation between vegetative performance and indoor comfort thresholds.

Preliminary findings indicate that plant selection based on ecological adaptation and spatial strategy contributes to reductions in peak indoor temperatures, improved hygrothermal stability, and measurable gains in the Thermal Comfort Index during extreme summer conditions. The results support the hypothesis that, **when integrated into architectural design as an active environmental system, botanical criteria can function as a quantifiable bioclimatic control mechanism in Mediterranean residential architecture.**



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sciforum-172095: THE URBAN IMPACT OF THE CORVIN CASTLE OF HUNEDOARA: HERITAGE PRESERVATION AND SPATIAL DEVELOPMENT

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Corvin Castle in Hunedoara is an important heritage site whose preservation is closely linked to urban planning, sustainability, and local development processes. As historic cities face pressures related to tourism, economic change, and spatial transformation, heritage conservation plays an increasingly relevant role in guiding urban development. This study examines how the preservation of Corvin Castle influences planning policies, the surrounding urban environment, and local adaptation strategies.

The research uses a mixed-methods approach that combines historical and morphological analysis of the urban fabric with spatial mapping of protected and buffer zones. Planning documents and heritage management policies were analyzed to evaluate how conservation principles are reflected in regulatory frameworks. Interviews with planners, heritage specialists, and local stakeholders provided additional insight into governance practices and institutional capacity. This approach responds to current discussions on urban planning, resilience, and sustainable development.

The results show that Corvin Castle functions as a significant spatial reference point within the city, shaping land-use patterns, mobility connections, and the organization of public spaces. Heritage-based regeneration projects support local economic activity and contribute to strengthening community identity. At the same time, challenges remain in balancing preservation requirements with infrastructure upgrades and functional modernization, pointing to the need for better coordination within planning and resilience strategies.

Overall, the study highlights the value of integrating heritage conservation into broader urban development frameworks in order to support coherent, sustainable, and context-sensitive urban transformation.



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sciforum-172727: Towards Climate-Resilient Affordable Housing in Addis Ababa: An Analysis of Heat Islands

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Due to rapid urbanization, cities in developing countries are increasingly affected by climate change, including rising urban temperatures. Understanding the spatiotemporal relationship between Land Use/Land Cover (LULC) change and Land Surface Temperature (LST) is crucial for sustainable, affordable housing development and for ensuring urban resilience by monitoring the Urban Heat Island (UHI) effect. This study employed remote sensing data to explore the spatiotemporal relationship between LULC and LST in Addis Ababa, Ethiopia. In addition, the study analyzed the spatial variabilities of LST values and the relationship between LST and different spectral Indices. Random Forest (RF) and geostatistical methods were employed for LULC classification and for determining the spatial variabilities of LST, respectively.

The findings highlight the increases in built-up areas between 2015 and 2020 and between 2020 and 2025. In comparison, vegetation and bare land LULC have decreased from 2015 to 2020 and from 2020 to 2025. The LULC also correlated with the LST. The highest mean LST value was found in the built-up areas. Bare land had the second-highest mean LST value after built-up areas. Vegetation land cover had the lowest mean LST value. The correlation analysis indicated a negative relationship between LST and the NDVI, SAVI, and MNDWI. In contrast, positive correlations were found between LST and the BSI and the NDBI. The results from the hotspot analysis revealed significant heat islands (hotspots) in the city center in 2015. However, heat islands have expanded rapidly to the outskirts of cities, implying gaps in the climate resilience of affordable housing units. The study's insights highlight the need for preventive measures in hotspot areas by integrating resilient design into affordable housing through actionable strategies to enhance its resilience and sustainability amid rapid urbanization and climate change. Increasing vegetation cover, using light-colored buildings, and incorporating green infrastructure have helped mitigate the rising heat effect in affordable housing areas.



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sciforum-163009: Towards Universal Accessibility in Cultural Heritage Sites of Ávila (Spain)

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Introduction: Ensuring universal accessibility in historic urban environments is essential for creating sustainable, inclusive, and socially equitable cities. Cultural Heritage Sites play a central role in shaping urban identity, yet often present significant physical, communicative, and cognitive barriers. This study examines the accessibility conditions of cultural heritage across Ávila (Spain), a UNESCO-recognized historic region, applying a framework aligned with Sustainable Development Goals 10 and 11. The project aims to evaluate accessibility comprehensively and propose context-sensitive improvements compatible with heritage conservation.

Methods: This research adopted a broad evaluative framework that combined observational analysis, site visits and qualitative insights from local heritage managers. Universal accessibility was examined through four fundamental dimensions: (i) Deambulation, (ii) Apprehension, (iii) Location and (iv) Communication. The combination of general quantitative patterns and descriptive qualitative evidence enabled the identification of common barriers, opportunities and trends across different types of sites.

Results: The analysis reveals moderate improvement in aspects related to physical access, while more substantial challenges persist in the areas of orientation, information availability and communication for diverse user needs. Frequent limitations included irregular pavements, insufficient signage and a lack of inclusive information formats. However, several positive practices were identified, such as reversible architectural adaptations, enhanced lighting strategies and the introduction of digital solutions that support accessible cultural experiences.

Conclusions: This study demonstrates that universal accessibility and heritage preservation are compatible and mutually reinforcing objectives when grounded in evidence-based, reversible interventions. The framework offers a replicable model for enhancing inclusive urban environments, contributing to sustainable cultural management and equitable access for all citizens.



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sciforum-175928: URBAN DIGITAL TWINS AND EMISSIONS CONTROL IN MADRID: A CRITICAL ASSESSMENT FOR DECISION-MAKING IN BUILDINGS AND TRANSPORT

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This study explores data science-based solutions to address climate change and promote healthier and more sustainable cities. In this context, digitalization and the development of Urban Digital Twins (UDTwS) are considered tools with the potential to contribute to CO₂ emissions control(1,2,3, 4,5).

The case of the city of Madrid is examined, where greenhouse gas emissions are structurally concentrated in building energy consumption and road transport (6,7,8) –sectors characterized by strong infrastructural inertia and long asset life cycles. Digital Twins have shown to be the most effective way for Facility Management and Data-backed decision-making [ref]. In this case, UDTwS are emerging as digital infrastructures capable of integrating real-time data, simulation, and predictive analytics to optimize these systems. However, technological optimization does not automatically translate into effective emissions control.

This paper critically assesses whether Madrid should implement an Urban Digital Twin as a decision-support system to control CO₂ emissions in the building and transport sectors, in alignment with the principles of Industry 5.0. Based on a review of recent scientific literature and comparative international case studies, the study proposes a multi-layer digital twin architecture and evaluates its technological capabilities, economic feasibility, institutional requirements, and systemic risks. The findings indicate that emissions control ultimately depends on governance maturity, regulatory compatibility, and the implementation of effective public policy instruments.

This research is part of the project “Data Science and Urban Digital Twins for Emissions Control in Transport and Buildings,” developed within the MOMENTUM Programme of the Ministry for Digital Transformation and Public Administration and integrated into the CSIC Interdisciplinary Thematic Platform PTI Mobility 2030. The research has been further enriched through the development of the Executive Master in Digital Twins, co-funded by the European Union and jointly organized by leading European civil engineering universities (UPM, ENPC and BME).



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sciforum-155791: Urban geo-thermodynamics mechanism of surface warming for thermal risk assessment in the Haldia urban–industrial region: A mathematical integrated approach for sustainable urban heat resilience

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Rapid urban–industrial development has intensified surface warming in global cities, including India, posing critical challenges for sustainable urban environments. While advanced AI and remote sensing methods have mapped urban heat patterns, a fundamental thermodynamic understanding of how cities generate, absorb, store, and dissipate heat with the urban land transformation remains underexplored. This study conceptualizes the urban geo-thermodynamics mechanism as a comprehensive framework for quantifying urban surface energy exchanges, heat-flux dynamics, and thermal responses in the Haldia urban–industrial region (103.84 km²) of eastern India. The analysis employs Landsat-derived impervious surface expansion, land surface temperature (LST), and normalized difference vegetation index (NDVI), NASA POWER radiation fluxes, World Settlement Footprint 3D structural (2023) and material stock (2024) data, and census-based population records (1991–2021). The integrated mathematical formulations were developed after the remote sensing-GIS-based statistical analysis for the urban energy balance through the Urban Thermodynamic Index (UTI), Urban Heat Retention Efficiency (UHRE), and Urban Cooling Potential (UCP) indices, which were developed from energy balance equations linking net radiation (Q^*), anthropogenic flux (Q_F), and latent/sensible heat terms (Q_E , Q_H). The results reveal a 36% increase in UTI and a 28% rise in UHRE between 1991 and 2021, indicating enhanced surface heat accumulation and anthropogenic energy input associated with built-up and population growth (22.87–53.37 km²) and (1452–2375 person/km²). In contrast, UCP declined by 22%, reflecting reduced evaporative cooling due to vegetation loss, and the regression-based calibration ($R^2 = 0.89$; RMSE = 0.74°C) validated the correspondence with observed LST. These findings demonstrate a quantifiable link between thermodynamic processes and the transformation of urban morphological landscapes. The proposed mathematical–thermodynamic structure provides a transferable, GIS-based statistical method for urban heat risk assessment, energy-efficient planning, and geothermal environmental management, supporting global initiatives toward climate-resilient and sustainable urban development.



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sciforum-175925: Urban Impacts on Avifaunal Community of Kannur Dist., Kerala, India

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This paper primarily focuses on clarifying the impact of urbanisation on avifaunal communities in Kannur, Kerala. Urbanization and human activity will degrade environmental quality and homogenize plant and animal populations. One of the most prevalent species on the planet, birds are the ideal tool for tracking environmental changes and are hence considered ecological indicators. The diversity and composition of birds varied by habitat type. This study aims to monitor whether urbanisation acts as a filter for species diversity and to test the Intermediate disturbance hypothesis along the urban–rural gradient. Based on building density, the study area is divided into three classes, namely urban, suburban, and rural, using ArcGIS and selecting 20 points from each class. Then we conducted bird point counts at 60 sites along the urban-to-rural gradient in Kannur. PAST (Paleontological Statistics) software was used to calculate the diversity and abundance of the birds for 2 seasons. A total of 428 individual birds were recorded; 44 species were monitored in the January–February season, followed by 309 individual records of 39 species in the March–April season. Our findings do not support the intermediate disturbance hypothesis (IDH), as bird diversity is highest in the rural area, followed by suburban and urban areas, in both seasons. These findings support the idea that urbanisation acts as a filter, as the number of species in urban habitats is significantly reduced, mainly due to the biotic homogenisation of birds and their habitats.



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sciforum-145973: Urban Tree Heritage: Strategies for Conservation and Decision-Making in a Historic Maghreb City

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Urban vegetation plays a critical role in creating resilient and livable cities. Remarkable urban trees, particularly those from colonial periods, serve as ecological, cultural, and historical landmarks. They provide multiple benefits, including microclimate regulation, support for biodiversity, aesthetic and recreational value, and social well-being. In Tunisia, the patrimonial value of urban trees remains largely overlooked, highlighting the need for systematic assessment, conservation, and management strategies. This study focuses on colonial-era trees in Sousse, Tunisia, aiming to evaluate their patrimonial value and develop a decision-support tool for sustainable urban tree management. The study covered three districts of Sousse: Khzema, Jawhara, and Sidi Abd Elhamid. Trees were inventoried and georeferenced, and each tree was documented using an identity sheet containing location, species, vernacular name, dimensions, and site-specific constraints. Patrimonial values were assessed using a structured evaluation grid covering landscape (weighted ×2), cultural-symbolic, intrinsic, and functional values, scored from 0 to 5. Field surveys and landscape analysis were complemented by geospatial techniques to create thematic and summary maps supporting comparative assessment and planning. Trees located in organized parks and gardens exhibited significant patrimonial value, though they remain underappreciated. Trees in neglected or unplanned spaces scored lower, indicating a need for intervention and targeted conservation efforts. Visual representation of scores highlighted priorities for management and valorization. This study demonstrates that combining inventory, geospatial analysis, and structured evaluation provides an effective framework for urban tree conservation. Implementing such tools supports sustainable management, promotes ecological and social benefits, and fosters awareness of urban green heritage. Engaging local authorities and communities is essential to ensure long-term preservation and valorization of these living historical assets.



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sciforum-175939: Urbanisation and its Impact on Landscape Transformation of East Kolkata Wetlands

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Rapid urban expansion in developing countries has intensified pressure on peri-urban wetlands, leading to significant ecological transformation. The East Kolkata Wetlands (EKW), a designated Ramsar site on the eastern fringe of Kolkata, serves as a globally recognised model of wastewater-fed aquaculture and resource recovery. However, accelerating urbanisation and infrastructure growth have increasingly altered its landscape structure and ecological integrity. This study investigates the spatio-temporal dynamics of land use and land cover (LULC) change in the East Kolkata Wetlands over the past three decades using multi-temporal satellite imagery and geospatial techniques. Supervised classification methods were applied to map major land categories, including wetlands, water bodies, agricultural land, vegetation, and built-up areas. Landscape metrics, including patch density, fragmentation index, and connectivity measures, were computed to assess structural transformations and ecological stability. The results indicate a substantial increase in built-up areas, accompanied by declines in wetland extent and agricultural land. Water bodies exhibit increasing fragmentation and reduced spatial connectivity, reflecting the conversion of ecologically functional zones into urban land uses. These transformations compromise key ecosystem services, including wastewater treatment, flood regulation, biodiversity conservation, and livelihood support for local communities dependent on wetland-based activities. The study highlights the urgent need for integrated urban planning, stricter enforcement of wetland protection policies, and continuous spatial monitoring to ensure sustainable coexistence between urban growth and wetland conservation in rapidly expanding metropolitan regions.



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sciforum-175665: Urbanization, Vegetation Loss, and Biophilic Sustainability: A Geo-Statistical Investigation in Kolkata Metropolitan Area

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The Kolkata Metropolitan Area (KMA) has grown very fast over the last few decades, but this rapid urban growth has also damaged the natural environment. This has raised serious concerns about the city's future sustainability. In this study, we analysed land-use changes, examined how urban growth is linked to vegetation loss, and studied how ecological conditions have changed across the region. We used satellite images from 1991 to 2025 and predicted land-use changes up to 2050. The results show that built-up areas increased from 21.97% in 1991 to 50.46% in 2025, and they are expected to reach 65.41% by 2050. At the same time, vegetation cover decreased sharply from 26.08% to only 6.33% by 2050. This means that as built-up areas increase, green cover decreases. However, urban growth is not the only reason; other social and spatial factors also influence vegetation loss. Satellite indices also confirm this change. The Normalised Difference Built-up Index (NDBI) increased from 0.26 to 0.55, while the Normalised Difference Vegetation Index (NDVI) decreased from 0.68 to 0.43. This clearly shows that natural green areas are being replaced by concrete and impervious surfaces. Moreover, per capita green space in most municipalities has dropped below the World Health Organization's recommended minimum of 9 square meters per person. These changes show that the region is facing a large-scale biophilic deficit, meaning there is a shortage of nature within the urban environment. This leads to ecological fragmentation, loss of ecosystem services, and lower environmental resilience. Overall, the findings highlight the urgent need for better urban planning. Policymakers and planners should promote nature-based solutions, green infrastructure, and biophilic planning strategies to ensure sustainable and climate-resilient development in the KMA.



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sciforum-164984: Växjö's Fossil Fuel-Free Initiative: A Case Study on the Challenges of Achieving Carbon Neutrality in a Small City

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Sweden aims to achieve carbon neutrality and become a fossil-free welfare society by 2045. At the national level, 39 of 290 Swedish municipalities have set a target to achieve net-zero emissions before 2045. The Swedish municipality of Växjö has set an ambitious climate goal: to become a fossil-fuel-free city by 2030. Växjö has long strived to become an eco-smart, green, and healthy, growing, and inclusive city, and create a community that stops causing any negative climate impacts by 2030. The study applies Energy Transition Theory to analyze the municipality's strategies and social-technical challenges. A qualitative case study research method was used to answer three research questions: the current strategies, challenges (in technology, policies, and social aspects), and solutions implemented by Växjö Municipality. The policy document and municipal published reports from Växjö municipality provide the empirical data. Four online interviews were conducted to provide the first-hand data. The conclusion shows that Växjö has fallen behind in achieving carbon neutrality compared to other Swedish peer cities, and there are gaps between symbolic actions (e.g., green branding) and real sustainable practices. The transition to a just and inclusive framework is needed to reconcile the rhetoric with reality for Växjö. This research fills the gap in a deeper understanding of complex dynamics in a small municipality like Växjö to achieve carbon neutrality and a fossil-fuel-free ambition, contributes to understanding the complex dynamics of local sustainability efforts, and contributes to the growing literature on energy transition theory in a specific city. It also offers practical insights for other municipalities, especially small cities pursuing similar climate goals.



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sciforum-166454: Water in public spaces: technical and sanitary challenges of small-scale closed-circuit urban installation

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Small-scale water architecture with closed-circuit systems has become an integral component of contemporary public spaces, contributing to their aesthetic quality, recreational value, and social attractiveness. Elements such as fountains, interactive water features, and ornamental basins are increasingly important in urban design strategies aimed at improving the quality of life in cities. However, alongside these benefits, closed-circuit water installations generate a range of technical and sanitary challenges that require careful consideration.

Water circulating in a closed system is continuously exposed to environmental factors such as temperature fluctuations, airborne pollutants, organic matter, and intense human interaction. These conditions significantly increase the risk of biological and chemical contamination, including the development of pathogenic microorganisms and the accumulation of harmful substances. In public spaces with unrestricted access, these risks are further intensified by direct user contact, particularly in interactive installations designed for play and recreation.

A major challenge in this context is the lack of clear, comprehensive legal regulations governing the design, operation, and maintenance of closed-circuit water features in public spaces. Existing standards are often fragmented, ambiguous, or adapted from swimming pool or drinking water regulations, which do not fully address the specific characteristics of small urban water installations. This regulatory gap complicates effective supervision, quality control, and responsibility allocation among stakeholders.

The analysis presented in this research highlights the urgent need to develop coherent guidelines that integrate technical, sanitary, and legal perspectives. Such guidelines should encompass system design, water treatment technologies, monitoring procedures, and operational practices. Only through an interdisciplinary, integrated approach can closed-circuit water installations operate safely, sustainably, and responsibly within the urban public realm..



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sciforum-181841: Evaluating Rain Garden Efficacy for Sustainable Urban Stormwater Management

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The expansion of impervious surfaces, combined with ongoing climate change, has led to significant environmental impacts, most notably urban flooding. The rising frequency of these events underlines the inadequacy of conventional urban drainage systems, necessitating a strategic transition toward sustainable and resilient stormwater management. Within this framework, Nature-based Solutions (NbS) represent a key strategy, offering multifunctional and regenerative methods to strengthen urban resilience against intensifying environmental hazards. Among the several types of NbS, the Rain Garden (RG) is a bio-retention system designed to intercept, temporarily store, and treat stormwater runoff generated by surrounding impervious surfaces. However, despite a broad consensus on the advantages of RGs, their large-scale implementation remains limited. Thus, this study evaluates the hydrological efficiency of a rain garden proposed for a specific site in Cerisano, Southern Italy. By utilizing EPA-SWMM software to develop a predictive model across different RG configurations, the research explores how varying design parameters influence system performance. The findings confirm that RGs are a reliable strategy for urban stormwater control, highlighting that their hydrological performance is highly dependent on specific design variables. The demonstrated efficacy of this sustainable approach supports its widespread adoption as a tool for addressing the environmental pressures of modern urbanization. Acknowledgements: This work was funded by the Next Generation EU - Italian NRRP, Mission 4, Component 2, Investment 1.5, call for the creation and strengthening of 'Innovation Ecosystems', building 'Territorial R&D Leaders' (Directorial Decree n. 2021/3277) - project Tech4You - Technologies for climate change adaptation and quality of life improvement, n. ECS0000009. This work reflects only the authors' views and opinions, neither the Ministry for University and Research nor the European Commission can be considered responsible for them. We would like to thank the Municipality of Cerisano for supporting these project activities as a stakeholder.



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sciforum-181673: Application of renewable energies in vehicles in the Mediterranean Urban Environment

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Renewable energies can be used in the development of public passenger vehicles to reduce energy consumption and improve passenger comfort and the sustainability of urban environments.

In this work, a case study of a train carriage is analysed. The carriage is built with five modules. Each module is composed mainly of surrounding panels and lateral windows. It is equipped with photovoltaic cells located in the ceiling (horizontally) and lateral (vertically and inclined) panels.

The numerical study evaluates the direct and diffuse solar radiation, photovoltaic production, and mean energy produced during the day. The study is conducted in a Mediterranean environment on a winter day with a clear sky, when the train moves from north to south.

The ceiling is exposed to solar radiation throughout the day, with the left side receiving sunlight in the morning and the right side in the afternoon. The solar radiation level peaks on the ceiling at midday, on the left panel at 9 am, and on the right panel at 3 pm. The lateral panels generate 59.5 % of the energy produced by the ceiling panels. The lateral panels below the windows account for 45% of the energy of the panels above them. Each carriage module generates approximately 10.5 kWh during the day, which contributes to the artificial lighting (passenger visual comfort), ventilation (passenger indoor air quality), and heating systems (passenger thermal comfort). As electrical photovoltaic production varies throughout the day, storing excess energy in batteries enhances system management. In winter conditions, energy production is not limited to horizontal cells.

Due to the altitude of the sun, it also occurs in vertical photovoltaic cells, which represent an important contribution to the sustainability of the vehicle and, therefore, the urban environment.



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sciforum-172792: The Influence of Temporal Variations on the Perception of High Street Soundscapes Across Grey, Green, and Blue Typologies

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Daily and weekly variations shape how people perceive streetscapes. These environments typically include vegetation, built form, and water features, which provide a basis for classifying high streets into grey, green, and blue typologies. Street typologies were classified based on observed environmental characteristics using a structured framework. This study aims to investigate how day-of-week and time-of-day variations shape soundscape perception – specifically dimensions of eventfulness, pleasantness, vibrancy, and calmness – across grey, green, and blue high-street typologies in London, to inform temporally responsive design strategies. To address this, data were collected at sites in Chelsea and Camden through 10 autonomous soundwalk groups across nine specified locations. The acoustic and perceptual data were analysed using the Kruskal-Wallis and Mann-Whitney U nonparametric tests, which are appropriate for non-normally distributed perceptual data.

Overall, the results indicate that temporal differences—particularly day-of-week and time-of-day—affect how grey, green, and blue high streets are perceived. In grey locations, weekend sound atmospheres are perceived as more vibrant. In green locations, weekends are perceived as calmer and quieter than weekdays, while weekday soundscapes are perceived as more chaotic. From an hourly perspective, grey locations are perceived differently throughout the day, with early hours perceived as more pleasant and vibrant. Mann-Whitney U test results also suggest that, in green spaces, early hours are perceived as more uneventful, calm, and monotonous, whereas later in the day increased people and traffic sounds are associated with higher perceived eventfulness and chaos. These findings suggest that high-street design should incorporate temporally responsive soundscape and environmental design approaches, rather than relying solely on static interventions.



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Session 3. Urban Economies and Resource Management

sciforum-175974: Urban Land as a Financial Resource: Lessons from Land Value Capture in Ahmedabad (India)

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Cities are increasingly turning to private investment to fund public infrastructure by treating urban land as a financial resource through Land Value Capture (LVC) tools. In India, LVC has gained attention in recent years, with national and state planning frameworks encouraging cities to use land-based financing methods to support infrastructure development and urban growth. Although LVC is often seen as an innovative solution to funding challenges, its growing use raises important questions about economic resilience, governance, and the long-term sustainability of urban resource management.

This paper uses Ahmedabad as a case study to examine the Sale of Development Rights (SDR), an LVC tool included in the city's Development Plan, and explores how urban land is turned into funds for public infrastructure financing. By examining legal guidelines and municipal budget data, it tracks the increasing role of SDR in city revenues and evaluates its impact on urban financial stability and planning goals.

This study shows that relying more on SDR can expose cities to financial risks associated with real estate market cycles and wider economic trends. This reliance may limit municipal independence and affect development choices as funding for infrastructure becomes closely linked to private market forces. By turning development rights into financial assets, LVC tools change how urban land is governed as a public resource, impacting fairness, spatial planning, and equitable access to urban infrastructure.

This paper concludes that while LVC can effectively add to municipal revenues, excessive dependence on private investment carries significant financial risks. It contributes to debates on how cities can balance growth-oriented financing mechanisms with economic stability and equitable resource management.



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sciforum-172672: Analysis of urban-tourism development trends on the North Pacific Coast of Mexico

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The City of Mazatlán, Sinaloa, located on Mexico's North Pacific coast, has experienced accelerated urban growth over the past two decades. This expansion has occurred without adequate planning or effective sustainable development strategies, as the population increased from 327,989 inhabitants in 2000 to 441,975 in 2020. The city has a housing density of 2,188 units per km² and a Prosperous Cities Index (PCI) score of 56.8, which is considered moderately weak and highlights the need to strengthen urban policies.

The objective of this study was to construct contextual, trend, and desirable scenarios for Mazatlán in order to analyze patterns of urban-tourism development. The research employed a mixed, non-experimental methodological approach. The quantitative phase involved photographic surveys to describe and compare elements of the urban-tourist landscape, identifying causes and effects of landscape transformation. The qualitative phase focused on diagnosing environmental and economic challenges. Integrating findings from both stages, scenarios were developed based on General Systems Theory.

The main results reveal that the annual influx of tourists multiplies the resident population by seven, generating competition for food, goods, and services. The absence of urban management strategies has undermined the continuity and conservation of wetlands, which are increasingly threatened by irregular human settlements, marina and port infrastructure, beachfront hotels, and vacation properties. These pressures degrade the natural landscape and lead to economic losses in fishing and aquaculture, pollution, the spread of disease vectors, unpleasant odors, surface warming, and a diminished capacity to provide ecosystem services. In conclusion, the study emphasizes that the primary strategy for Mazatlán's sustainable future must be rooted in conserving its existing landscape heritage.



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sciforum-175988: DECARBONIZATION AND ENERGY TRANSITION IN PORTUGAL: A PANEL DATA ANALYSIS IN THE EU CONTEXT

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The transition to low-carbon energy systems is a central objective of the European Union and a key requirement for sustainable economic and environmental development. Portugal has historically shown a high dependence on imported fossil fuels, which has affected energy security, carbon emissions, and economic stability. European climate policy has promoted renewable energy expansion, electrification, and efficiency improvements, but significant structural differences remain among member states in the effectiveness of decarbonization strategies.

This study applies a quantitative panel data approach to analyse the evolution of the Portuguese energy system in comparison with selected European Union countries over the period 1990–2025. The empirical framework is based on official energy and environmental indicators, including greenhouse gas emissions, carbon intensity, energy intensity of GDP, renewable energy shares, and external energy dependence. Data were obtained from national emission inventories, European statistical databases, and energy policy reports. Time-series analysis, cross-country benchmarking, and fixed-effects panel estimation were used to evaluate the relationship between renewable energy expansion, efficiency improvements, and emission reduction, while controlling for structural shocks related to economic crises and energy market volatility.

The results indicate that increases in renewable energy shares and improvements in energy efficiency are associated with significant reductions in carbon intensity. Portugal shows substantial progress in emission reduction and renewable electricity generation, but still presents higher external energy dependence compared with more efficient European economies. Countries with stronger policy integration and technological development demonstrate better environmental performance and greater resilience to energy shocks.

The findings confirm that the effectiveness of decarbonization policies depends on the combined effect of renewable energy expansion, efficiency improvements, and technological modernization. Strengthening these factors is essential for achieving long-term sustainability goals and for building resilient economic and urban systems in the European Union.



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sciforum-175973: Does Institutional Middleware Reduce Rent-Seeking in Smart Cities? Evidence from EU Digital Procurement

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Abstract: The rapid deployment of Urban Digital Twins (UDTs) and algorithmic decision-making systems promises enhanced efficiency in urban resource management. However, this digitalization often generates severe socio-technical frictions, primarily manifesting as algorithmic black boxes and vendor lock-in by major tech giants. Such technological exclusivity inherently restricts inclusive economic participation and exacerbates rent-seeking risks in public resource allocation.

This study introduces the concept of "Institutional Middleware"—a standardized regulatory and technical buffer comprising interoperability clauses (e.g., MIMs), open APIs, and algorithmic transparency requirements—and empirically tests its causal effect on mitigating rent-seeking behaviors in smart city procurement. Utilizing a comprehensive micro-dataset from the EU Tenders Electronic Daily (TED) database (2016–2025), we focus on high-complexity IT and software procurement contracts. Methodologically, we apply Natural Language Processing (NLP) to extract the intensity of institutional middleware clauses from unstructured contract notices. Subsequently, a high-dimensional two-way fixed effects model is employed to evaluate the impact of these clauses on the "single-bidder rate" (a globally recognized proxy for corruption and lock-in risks) and the market entry success of Small and Medium-sized Enterprises (SMEs).

Preliminary and expected results indicate that public digital contracts embedding strong institutional middleware significantly reduce single-bidder anomalies and increase SME participation. The findings suggest that interoperability and open standards serve not merely as technical specifications, but as crucial ex-ante anti-corruption mechanisms. By standardizing compliance and dismantling technological monopolies, institutional middleware effectively balances the efficiency–legitimacy trade-off, fostering a more inclusive and resilient urban digital economy during the twin transition.



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sciforum-160225: Feasibility study for solid waste management using smart waste bins in the municipality of Cuernavaca, Mexico

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Rapid urbanization and rising municipal solid waste (MSW) volumes have overwhelmed traditional waste collection systems in many Mexican cities, including Cuernavaca. The adoption of technologies like artificial intelligence (AI) and smart waste bins is emerging as a viable solution to enhance MSW separation, monitoring, and logistics. This research aimed to analyze the feasibility of implementing smart bins to improve MSW management in Cuernavaca City, Mexico. A mixed-methods approach was employed, including a literature review of smart bins in waste management over the past 10 years, an analysis of the local regulatory and institutional context, semi-structured interviews with experts, and an online survey of 253 residents of Cuernavaca. From this information, SWOT and CAME matrices were developed to identify strengths, weaknesses, opportunities, threats, and implementation strategies. The findings indicate that although a significant portion of the population already separates their waste, this practice is not widespread. Additionally, the waste collection system is primarily perceived as inefficient. Most residents were unfamiliar with smart bins before the research, but after a brief explanation, about 80% deemed them valuable. Furthermore, more than two-thirds expressed a willingness to participate in a pilot program, and many showed openness to receiving training and incentives, particularly in the form of service discounts. In conclusion, the implementation of smart bins in Cuernavaca is socially viable, provided it is aligned with a gradual design process, transparent governance and financing models, environmental education initiatives, and incentive mechanisms that encourage sustained citizen participation.



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sciforum-171086: Innovating DBL Business Models: Tokenomics, Smart Contract SLAs, Decentralised Knowledge Graphs and Smart Oracles

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Introduction

Digital transformation of the construction sector demands trustworthy, interoperable, and economically sustainable mechanisms for managing building-related data and services. The Horizon-Europe project BUILDCHAIN addresses this need by extending the Digital Building Logbook (DBL) with Decentralized Knowledge Graphs (DKGs), Decentralized Oracle Networks (DONs), and token-enabled business models to support continuous, verifiable, and machine-actionable building-lifecycle documentation.

Methods

BUILDCHAIN ecosystem tools and applications operate within a unified architecture supporting discoverability, access control and monetization. Datasets are transformed into Knowledge Assets (KAs), semantically linked with the DKGs, validated within the DONs by using a reputation-based mechanism, and stored immutably, ensuring that data providers can confidently monetize their assets. Smart contracts, including Service Level Agreements (SLAs), manage access, payments, and service execution, supporting subscription-based, usage-based, or hybrid pricing. A tokenized economic layer enables seamless transactions, access control, automated regulatory compliance and verifiable ownership of digital assets. Economic sustainability is evaluated through multi-actor Business Model Canvases and Value Network mapping, identifying the cost structures and value propositions of urban economy chain stakeholders, demonstrating a win-win sustainable ecosystem.

Results

Three interconnected markets are supported: a service marketplace for BUILDCHAIN tools, a data marketplace for monetizing building-related datasets, and a side market enabling third-party applications to integrate with the DBL, DONs, and Building Information Modeling (BIM) ecosystem. Digital wallets and token-based remuneration streamline partner compensation, enabling transparent, traceable economic flows. The architecture's viability is shown through a representative scenario where a building-energy-efficiency tool uses DBL data and DON weather feeds to optimize HVAC operation. Results demonstrate stakeholder benefits and building-stock improvements that, when scaled, allow buildings to act as flexible grid resources and enhance city-wide resource-management efficiency.

Conclusions

BUILDCHAIN introduces a scalable, tokenized, Oracle-enhanced business model that transforms DBLs from static repositories into dynamic economic infrastructures, enabling new forms of data monetization, service innovation, and cross-sector value creation in built environments.



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sciforum-172755: Regulatory Determinants of Urban Land Markets: A Comparative Analysis of Policy Impacts and Market Efficiency in India

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Regulatory frameworks, encompassing policy, land use, and financial instruments, fundamentally shape urban land markets and development trajectories. In rapidly urbanizing nations like India, these frameworks often struggle to balance the need for orderly growth with market efficiency. This study aims to analyze the evolution of diverse regulatory frameworks and their specific impacts on urban and peripheral land development in India, utilizing international benchmarks to highlight unique challenges and areas of convergence. The research employs a systematic scoping review to map and categorize multidisciplinary regulatory frameworks across urban economics, planning, and public policy. A structured selection process was conducted, initially identifying over 2,000 records. Through rigorous filtering, the pool was refined to 58 relevant studies, which were then thematically analyzed under categories of theory, case studies, and specific regulatory types. Findings indicate that while market-based land allocation enhances urban productivity compared to administrative systems, rigid land use regulations such as strict Floor Area Ratio (FAR) limits and Urban Growth Boundaries (UGBs) often lead to significant housing price inflation and welfare losses. For example, Mumbai's uniform and restrictive FSI policy has historically constrained floor space supply, driving prices upward and forcing a majority of the population into informal settlements. Furthermore, case studies from the UK and India demonstrate that containment policies frequently fail when overridden by fiscal interests, leading to uncontrolled sprawl. While Indian reforms like RERA (2016) and LARR (2013) have improved transparency and compensation, enforcement disparities continue to undermine market dynamism. The study concludes that although regulations are essential for guiding sustainable growth, overly rigid or outdated structures often induce unintended consequences, including market distortions and increased informality. A nuanced, context-specific approach is required to balance private property rights with public interests. Future urban resilience depends on integrating risk assessments into zoning and improving coordination between state-led regulations and market-led development.



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sciforum-175845: The political economy of localised privatism: Reconceptualising the urban informal economy in Namibia

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The urban informal economy in the Global South is normally associated with negative connotations, such as illegality and transience. As a result, many regulations at the national and local levels appear to focus on how to control or minimise the expansion of this sector. Largely missing from many of these interventions is a proper understanding of the socio-spatial context that creates and perpetuates this economy. This paper thus seeks to unpack the nuances associated with the urban informal economy. Based on a case study of Namibia, this study argues that, rather than being a nuisance in the urban landscape, the informal economy constitutes a localised form of privatism. This is evident in the entrepreneurial bent and creative ethos that define the activities of these traders. Moreover, the diversity of goods and services provided is noteworthy. There is also an indigenous element to the way business is conducted, as evident in the socio-spatial set-up of these operations. This economy emphasises sole proprietorships, partnerships and cooperatives. While formal workers' rights are not necessarily enforced, they are informally present through familial and kinship ties. The informal economy constitutes a source of livelihood for many, thus reducing pressure on the government to provide jobs. Contrary to the argument that this endeavour constitutes old forms of work, it embodies the changing nature of work through innovation, self-organisation and social networking. This paper contributes to the existing literature by articulating an economic justice framework for protecting the rights of traders and workers in the urban informal economy.



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sciforum-175656: Urban Economic Spillover Networks: Micro-Level Evidence of Functional Urban–Rural Integration in Sri Lanka

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Urban economic systems extend beyond city boundaries through complex transaction networks that include workers, raw materials, and food. However, consistent with urban–rural linkage theory, relationships are understood at macro levels, yet the household-level mechanisms through which these spillovers integrate rural settlements remain underexplored, particularly in developing-country contexts. Therefore, this study investigates the household transaction mechanisms linking rural economies to urban systems with the aim of understanding whether rural households connected to nearby towns operate as economically embedded extensions of urban systems rather than as isolated agrarian units. Two hypotheses were tested: urban economic spillovers are transmitted through interrelated employment, market exchange, and credit networks; and households with stronger urban-linked employment exhibit different financial conditions and labour allocation patterns compared to less connected households. Primary data were collected with structured questionnaires via a field survey. A sample of 100 was selected through stratified random sampling from 802 households in a rural settlement functionally connected to nearby urban centers. Descriptive statistics were employed to illustrate transaction patterns. A binary logistic regression model evaluated household financial status as the dependent variable, using employment characteristics as key explanatory variables. The Mann–Whitney U test assessed employment involvement both within and beyond the local rural economy. The findings indicated that agricultural output remains the primary means of livelihood (65%), with the majority targeted at urban markets. Employment trends demonstrated significant dependence on urban economic frameworks, with 31.2% of household heads working as plantation laborers, 25% as service providers, and 6% in manufacturing. Observations included formal and informal transaction categories, such as reciprocal labor exchange (50%), credit-driven purchases (24%), and formal borrowing from banks (10%). The research reveals micro-level pathways for spillovers, enhancing understanding of urban economic systems and guiding cohesive urban and regional planning to strengthen economic resilience and support sustainable urban–rural growth.



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Session 4. Urban Mobility and Transportation

sciforum-173592: Paper Bike Lanes for a Fragmented City. Cycling Infrastructure and Experience in San Martín de Porres, Lima, Peru.

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¹ Country: Peru | City: San Miguel, Lima | University: PUCP

The unequal urban growth of Lima has produced physical discontinuities in peripheral districts. Such is the case in the district of San Martín de Porres, located in the so-called Cono Norte, where unequal access to the available cycling infrastructure is evident.

This research examines the physical conditions for cycling mobility and their effects on the travel experience and the users' sense of appropriation of the road space. To this end, an exploratory-analytical approach is used. First, a cartographic survey of the main bike lanes was conducted, recording their continuity, physical and operational barriers. Then, attributes of connectivity and urban permeability were measured, such as intersection density, block size, and the quality of intersections. With this information, a synthetic fragmentation indicator was built, which allowed for a more precise analysis of the conditions affecting cycling mobility in the district. Finally, mobile ethnography was applied, in which conflicts of use, diversion strategies, and moments of tension were recorded.

The results show that, although there is a cycling network of approximately 20 km, it is disjointed. The mobile ethnography revealed that users are in constant dispute over the lane. Examples of this are observed at the intersections of Av. Universitaria with Av. Santiago Antúnez de Mayolo and Av. Universitaria with Av. Perú, where interruptions are noticeable, especially at the crossings. In these areas, the bike lane narrows and lacks safe separation from the highway, while deteriorated pavement and the invasion of trash worsen the conditions. The research highlights the importance of improving the existing bike lanes in peripheral districts, as the current deficiencies generate circulation conflicts and affect user safety. Improving them before expanding would ensure a more efficient and safer cycling network.



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sciforum-168679: A Stage-Gate Decision Architecture for Freight-Passenger Integration in Urban Public Transport Systems

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Urban public transport systems are traditionally designed for passenger mobility, while their latent operational capacity remains under-theorized as a strategic resource for urban logistics. Although recent research has explored freight-passenger integration and shared infrastructure efficiency, the field remains dominated by descriptive case studies and operational feasibility assessments. There is a lack of structured analytical frameworks capable of supporting systematic, multi-dimensional decision-making under technical, economic, and institutional uncertainty.

This study addresses this theoretical and methodological gap by proposing a Stage-Gate diagnostic framework grounded in Engineering Methods and Design Science Research. Rather than treating freight integration into Bus Rapid Transit (BRT) systems as an isolated operational experiment, the framework conceptualizes it as a sequential uncertainty-reduction architecture. The model structures feasibility assessment through five validation gates: (G1) contextual and territorial eligibility, (G2) physical and operational feasibility, (G3) service compatibility and interference control, (G4) logistical and economic performance, and (G5) governance, regulation, and scalability. Each gate incorporates explicit criteria, measurable indicators, and decision thresholds, enabling analytically grounded go/no-go decisions prior to implementation.

The framework is empirically applied to the TransCarioca BRT corridor in Rio de Janeiro, Brazil, using timetable analysis, occupancy patterns, and identification of idle operational windows. Our findings reveal stable off-peak capacity that can be strategically reallocated to middle mile logistics without compromising passenger service levels. Beyond empirical validation, the study contributes a formal decision architecture that advances the theoretical foundations of infrastructure sharing and freight-passenger integration by operationalizing uncertainty management within capacity-constrained urban systems.

By integrating decision-structuring logic, governance analysis, and infrastructure efficiency into a unified validation model, this research provides both conceptual advancement and a transferable methodological artefact for planners and policymakers.



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sciforum-173557: Cycling Is Not the Same for Everyone: Gender Inequality in the Cycling Mobility of PUCP Students

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The bicycle has become a key mode of transport for promoting sustainable urban mobility in Lima. However, various studies show that its use is not gender-neutral. Men and women experience urban mobility differently. This study analyzes university cycling from a gender perspective.

The research examines students who use a bicycle as a means of transportation for their trips to and from the Pontificia Universidad Católica del Perú (PUCP), located in the district of San Miguel, Lima. The study adopts a mixed-methods approach consisting of two stages. In the first stage, structured surveys were administered to student cyclists to investigate gender differences in cycling behavior. The instrument collected data on frequency, schedules, routes, and perceptions of safety. In the second stage, photographic records were made of the bike lanes most frequently used by students, and maps were produced to analyze the information obtained.

The results show clear differences in mobility patterns by gender. Women report lower nighttime use and a higher perception of risk. Men report greater circulation on shared roads. Female students prioritize routes with segregated infrastructure. The analysis confirms that cycling does not operate as a neutral practice but is shaped by gender inequalities. This study provides evidence for more inclusive urban mobility planning.



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sciforum-175914: Evaluation of Energy Harvesting from Pedestrian Movement Using Piezoelectric Flooring in Urban Mobility Infrastructure: A Case Study of “Les Fusilles” Metro Station, Algeria

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Urban mobility infrastructure is a major energy consumer in rapidly growing cities. Piezoelectric flooring tiles offer a promising solution for harvesting energy from pedestrian movement and creating an eco-friendly path in public facilities with high-density occupancy. This study tests the hypothesis that installing piezoelectric tiles in high-traffic transit zones can generate measurable electrical energy. The Algiers metro station, *Les Fusilles* (LFU), was selected as the case study due to its consistently high passenger volume and strategic location within the city's transportation network. The methodology is structured in three stages: first, collecting baseline data on daily passenger numbers and electricity consumption at LFU station; second, conducting in situ observations of pedestrian patterns to identify optimal zones; and third, selecting the type of Wayenergy tiles for this test based on their energy generation capacity, cost, and lifespan. Results show that installing the selected piezoelectric tiles in high-traffic zones could generate measurable electrical energy directly correlated with daily pedestrian frequency. This harvested energy can be used for station applications such as lighting and signage, or stored for later use. The findings confirm that Wayenergy piezoelectric flooring is a viable solution for enhancing urban sustainability, reducing carbon emissions, and supporting smart transportation systems in metropolitan environments.



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sciforum-175739: Multi-Resolution H3 Walkability Surfaces: A Scalable Framework for Cross-City Pedestrian Environment Assessment

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Introduction

Quantifying urban walkability at fine spatial resolution is essential for evidence-based active travel planning. Yet, existing indices typically rely on coarse administrative units or proprietary data, which impedes cross-city comparisons. This study presents the Hexagonal Walkability Surface (HWS) framework: a configuration-driven pipeline for computing multi-resolution walkability indices from geospatial data.

Methods

HWS employs the H3 discrete global grid to tessellate city extents at four hierarchical resolutions (levels 8-11). Five pedestrian-environment features are extracted per hexagon: (1) footway and path density (pedestrian edge length per km²); (2) point-of-interest accessibility, combining in-cell counts with an inverse-distance-weighted proximity score; (3) land-use diversity as Shannon entropy of intersecting land-use classes; (4) greenspace proximity, integrating coverage proportion with distance decay; and (5) road-safety ratio of pedestrian-friendly to total edge length. Street network and land-use data are sourced from OpenStreetMap; place data is augmented with Overture Maps (2026-02-18) via DuckDB S3 queries. Features are min-max normalised and combined as a weighted composite score (0-100). Spatial autocorrelation (Getis-Ord Gi*) is used to identify clusters of walkability.

Results

In Nottingham and Bristol, United Kingdom, the framework produces 1,178-57,700 and 2,581-126,518 hexagons per city, respectively, across resolutions 9-11. Across the resolutions, agreement is high (Spearman $\rho = 0.963-0.971$ between adjacent levels, all $p < 0.001$), confirming multi-scale consistency. At resolution 9 (roughly neighbourhood scale), intra-urban variation is observed in both cities ($\sigma = 11.4$ and 10.1 score points respectively), with city-centre hexagons clustering as hotspots and peripheral areas as coldspots. Gini coefficients indicate greater inequality in walkability in Nottingham (0.36) than in Bristol (0.26).

Conclusions

HWS provides a reproducible, data-agnostic methodology extensible to any city with OSM coverage. The multi-resolution design could support both strategic (neighbourhood) and street-block planning decisions. By making fine-grained walkability assessment accessible to researchers and planners without proprietary data or bespoke infrastructure, HWS lowers the barrier to evidence-based active travel policy at the urban scale.



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sciforum-172373: Rethinking Compact City Strategies in Car-Oriented Regional Cities: A Multi-Modal Accessibility Assessment of 15-Minute Urban Living under Limited Public Transport Networks in Japan

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The compact city concept has traditionally been associated with transit-oriented urban structures; however, many regional cities continue to rely heavily on automobile-based mobility due to limited public transport networks. This study raises critical questions regarding how future urban development strategies should be designed in car-oriented contexts. Using the concept of the “15-minute city” as an analytical framework rather than a normative goal, this study examines multi-modal accessibility to urban functional facilities in several regional Japanese cities.

A GIS-based network analysis was conducted to compare 15-minute accessibility across four transport modes—walking, bicycle, public transport, and private automobiles. Accessibility was evaluated not only in terms of spatial coverage but also in terms of population coverage, using high-resolution census mesh data. The analysis covers five regional cities and six types of frequently used urban facilities, including healthcare, retail, and administrative services.

The results indicate that automobile-based accessibility remains dominant in dispersed urban structures. In most cases, over 80–90% of the urban population can reach major facilities within 15 minutes by car, whereas the corresponding walking coverage remains substantially lower. Bicycles substantially expand accessibility compared with walking and provide moderate coverage in compact urban areas. Public transport improves accessibility in certain corridors; for example, the population reachable within 15 minutes increases by over 13,000 people in some cities, while in others the increase remains limited to only a few hundred residents, indicating significant spatial disparities.

Rather than advocating a universal transition toward transit-oriented compact cities, the findings suggest that future urban strategies in car-dependent regional contexts should adopt hybrid approaches that enhance local accessibility through walking and bicycle networks while strategically integrating public transport where feasible.



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sciforum-172469: A Spatial Multi-Criteria Decision Analysis Framework for Strategic Prioritisation of Shared Pathway Infrastructure to Enhance Community Connectivity in Coastal Cities: A Case Study in Tauranga, New Zealand

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Rapid urbanization in coastal cities intensifies the pressure on transport infrastructure, while fragmented active mobility networks limit equitable access to key destinations. Shared pathway infrastructure plays a significant role in enabling sustainable transport and social inclusion; however, limited public resources necessitate evidence-based prioritisation of pathway investments to guide future investment decisions and maximise community benefits. This study developed a spatial multi-criteria decision analysis (MCDA) framework based on available spatial data to assess and prioritize shared pathway linkages in Tauranga, New Zealand. In total, 21 indicators were defined and grouped into eight criteria. The process involved a comprehensive literature review conducted across multiple databases and Multi-Attribute Utility Theory (MAUT) analysis. The conducted MAUT analysis resulted in the development of rules for a more standardized assessment of 91 existing and 128 potential pathway linkages. This assessment is based on participatory evaluation and introduces a utility-function-based hierarchical spatial model. Within the model, eight primary criteria contain network gaps and missing connections, access to key destinations, suburb-to-suburb connectivity, safety deficit areas, equity and accessibility gaps, environmental and feasible corridor opportunities, and cultural significance, forming the basis for a comprehensive analysis of key pathway performance dimensions. To assess the relative significance of indicators, two distinct weighting scenarios were applied: one based on expert evaluation and the other based on equal weights. The results reveal noticeable differences between the two applied approaches. The equal-weight scenario identified 20 high-priority linkages but under- or over-emphasised certain pathways. However, the expert evaluation reduced this distortion and revealed clearer distinct prioritisation patterns. The findings underscore the importance of participatory planning in optimising shared pathway infrastructure in coastal cities. Therefore, the primary contribution of this study not only involves the prioritisation outcomes but also the novel methodological framework, which combines the MCDA framework with MAUT and stakeholder inputs.



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sciforum-173585: Active Mobility and Cycling Infrastructure Quality: Analysis of the Bike Lane on La Marina Avenue in Pueblo Libre, Lima

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Active mobility, particularly cycling, has become a relevant component of sustainable urban mobility in several Latin American cities. However, the existence of bike lanes does not necessarily guarantee adequate conditions of safety, comfort, and connectivity for users. In this context, La Marina Avenue, located in the district of Pueblo Libre, represents one of the main road corridors in Metropolitan Lima. Along this corridor there is a heavily used bike lane, despite physical deterioration and deficiencies present in several of its sections.

This research aims to evaluate the quality of cycling infrastructure along the sections of La Marina Avenue between Brasil Avenue and Universitaria Avenue. It also seeks to analyze whether the design and current condition of this infrastructure adequately respond to its role within the city's active mobility system.

To achieve this, the study proposes a methodology based on a multidimensional evaluation approach, taking as reference the work of Zhaoqiu Tan and Jinru Wang (2025). This approach integrates criteria related to structural connectivity, mixed-traffic interference, cycling environment comfort, and continuity in the presence of urban barriers. The research also adapts the Analytic Hierarchy Process (AHP) to the urban conditions of the case study. The analysis is supported by field observation, spatial analysis of the corridor, and systematic recording of the physical and functional variables of the bike lane.

The results reveal significant contrasts in infrastructure quality along the studied corridor. Sections with higher levels of traffic conflict, pavement deterioration, lighting issues, and discontinuities in the cycling network are identified. Finally, the study establishes a precedent for the analysis of other urban corridors and contributes to planning efforts aimed at improving active mobility and road safety in Metropolitan Lima.



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sciforum-172675: Beyond Metropolitan Boundaries: A Firm Network-Based Assessment of Regional Rapid Transit Potential in India

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Urban mass transportation research has predominantly focused on the metropolitan scale and population. However, with the growing body of urban literature on global cities and polycentric urban regions, it is timely to assess the rapid transit potential of urban regions comprising multiple cities in close proximity. Rather than relying solely on population size or spatial proximity, this study is based on the premise that high-capacity transit systems are more viable where strong business linkages exist between cities. In the Indian context, rapid transit research has largely concentrated on Tier-I cities, with limited attention to regions beyond these metropolitan areas. This study addresses the gap by focusing on urban clusters formed by Tier-II cities and evaluates their potential for regional rapid transit by assessing intercity firm linkages. However, the firm network is constructed using both Tier-I and Tier-II cities, as Tier-I cities function as key hubs in the national firm network and mediate a large share of intercity linkages. Firm linkages are derived from office location data of advanced producer service firms using the interlocking network model across 96 cities in India, thereby constructing a nationwide intercity business network. The subsequent cluster identification and evaluation focus only on spatially proximate Tier-II cities. Clusters are identified and evaluated in two configurations, city pairs and multi-city corridors. For each cluster, a composite index combines linkage intensity, network centrality, population, and intercity distance to rank clusters. The analysis is intended as a preliminary economic network based assessment of potential rather than system level feasibility. The results indicate that urban clusters with moderate population sizes can rank higher than larger clusters when strong business integration and network embeddedness are present. The findings highlight the importance of economic integration in shaping regional transit potential beyond conventional population-based criteria, informing policymakers in prioritizing capital intensive investments.



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sciforum-154649: Bridging Data Gaps for Smarter Decisions: Urban Microsimulation as a Strategic Tool

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Urban mobility planning in mid-sized cities often faces the challenge of insufficient or outdated data, limiting the development of reliable performance indicators for decision-making. Within the context of Transport System Models (TSM), this work presents a methodological proposal based on traffic microsimulation using open-source tools—specifically, the Simulation of Urban MObility (SUMO) platform—to support the estimation of key performance indicators (KPIs) related to sustainable urban mobility. The approach positions microsimulation as an operational-level component that complements traditional transport system analyses and ICT-based data sources in data-scarce environments.

As an initial case study, the downtown area of Bahía Blanca (Argentina) was selected due to its high traffic density and circulation complexity. A simplified microsimulation model is being configured using publicly available information on the street network, signal timing, and approximate traffic volumes, which are typical inputs obtained from urban ICT infrastructures. SUMO was selected for its open-access nature, transparency, and adaptability to urban contexts with limited data availability. In future stages, real-world traffic flow and vehicle-type data generated by our research group will be incorporated to improve traffic pattern accuracy and model calibration. Statistical validation metrics commonly used in transportation engineering, such as the GEH statistic, will be applied to support KPI estimation.

Preliminary experiments indicate that the proposed approach can reproduce general traffic dynamics and generate representative KPIs, including average speed, travel time, queue length, level of service, and estimated emissions. Although the results are exploratory due to current data limitations, they demonstrate the feasibility of integrating microsimulation within a broader TSM- and ICT-oriented decision-support framework to identify data needs and assess traffic management improvements.

The proposed framework contributes to the Sustainable Development Goals by supporting evidence-based mobility planning (SDG 11), promoting energy-efficient circulation patterns (SDG 7), and enabling the assessment of emission-reduction scenarios (SDG 13).



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sciforum-172435: CIRCULAR MOBILITY STRATEGIES IN SUSTAINABLE CITIES: A SYSTEMATIC LITERATURE REVIEW

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Since the 1972 Stockholm Conference, environmental concerns have gained prominence in the international agenda, leading to the establishment of the United Nations Environment Programme and strengthening global sustainability efforts (UNEP, 2022). Within this context, the circular economy (CE), conceptualized by Pearce and Turner (1989) based on Boulding's earlier work, has emerged as a leading framework for aligning environmental and economic systems (Ghisellini et al., 2016). Recently, CE principles have expanded into urban mobility and transport systems (Pamucar et al., 2023), reinforcing the need to understand how circularity and sustainability are integrated in mobility research. SDG 11 – Goal 11.2 reinforces the relevance of mobility in building more resilient and sustainable cities. Therefore, this paper aims to systematically map the literature published in the Web of Science (WoS) database regarding circular mobility in sustainable cities. It also aims to identify the circular economy's strategy that could be adopted to promote a more sustainable transport system. A systematic literature review was conducted in February 2026 using a PICO-structured search strategy and PRISMA (2020) guideline. The strings “(circular econom*) AND (cit*) AND (mobilit*) AND (sustainab*)” were applied in the WoS database without any initial refinement. Only papers published in journals were selected (50). After following PICO and PRISMA guidelines, 27 papers remained for the systematic literature review. The findings indicate that, while sustainability in transport is widely discussed, explicit integration of circular economy principles into urban mobility remains limited and fragmented. Most studies focus on technological optimization and smart mobility systems, having electric vehicles and sharing vehicles as the main “sustainable strategies”. Fewer address systemic circular strategies such as resource loops, lifecycle, and governance integration. The social and governance dimensions are still overlooked. These findings revealed the absence of frameworks to support a more integrated and systemic circular mobility policy in (sustainable) cities.



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sciforum-137141: Comfort and energy in public passenger vehicles in urban environments

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Public passenger vehicles are subject to external environmental conditions in the city and a high level of occupancy inside. To promote occupant comfort conditions, these vehicles should adapt to different climates and external environment conditions. When developing more energy-sustainable public passenger vehicles, it is important to consider not only these factors but also the vehicle design and HVAC systems. The main contribution of this work to the state of the art focuses on adapting the vehicle design, the internal occupation, and the HVAC system to the urban environment, namely external environmental variables. Air temperature and humidity, wind velocity, carbon dioxide concentration, solar radiation, occupancy levels, and HVAC systems were considered in evaluating passenger thermal comfort and indoor air quality. Numerical software will be used to simulate the thermal response of passenger transport vehicles. This software evaluates several layers of opaque (i.e., vehicle panels) and transparent (i.e., surrounding glass surfaces, such as lateral, back, frontal, and roof) bodies and respective temperatures, thermal comfort (i.e., PMV index), and indoor air quality (i.e., CO₂ level). The solar radiation, convection and radiative coefficients, energy flux, mass flux, and other factors are also calculated by the software. This numerical study considers a bus equipped with glass bodies on the lateral, frontal, back and roof surfaces, a high occupancy level, and the internal HVAC system. This study will be conducted in winter conditions, namely on the winter solstice on a clear day without clouds in a Mediterranean environment. External environments (e.g., solar radiation) and heat generated by passengers will be used to promote thermal comfort conditions. Air quality will be guaranteed through air renewal rates and ventilation topologies. According to the results obtained, the applied methodology ensures acceptable thermal comfort conditions and contributes to sustainable transportation in urban environments.



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sciforum-175657: Commuting Patterns in Metropolitan Regions of Romania: A Case Study on Railway Station Development Using GIS and Social Survey Methods

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Introduction:

Romania's 22 metropolitan areas exhibit significant disparities in commuting behaviors, shaped by uneven urban development, infrastructure investment, and transit accessibility. As the country seeks to align with the European Union's sustainable mobility goals, understanding how railway station development influences commuting patterns is critical for informed metropolitan planning.

Methods:

This original research integrates Geographic Information System (GIS) spatial analysis with a structured social survey conducted across all 22 Romanian metropolitan regions. GIS tools were employed to map the spatial distribution of railway stations, commuting corridors, and urban expansion from 2006 to 2021. Accessibility analyses modeled travel times to city centers by car and rail. Concurrently, the author conducted a stratified survey that captured commuter behaviors, modal preferences, and perceptions of station quality and transit integration.

Results:

Findings reveal stark regional disparities in modal split, with private car usage exceeding 80% in most metros, while rail accounts for less than 5% of daily commutes. Regions such as Bucharest-Ilfov and Cluj-Napoca, which have initiated metropolitan rail projects, demonstrate higher accessibility indices and emerging transit-oriented development (TOD) patterns. In contrast, smaller metros remain car-dependent, with limited rail integration and sprawling suburban growth. Survey data indicate that travel time, reliability, and station amenities significantly influence mode choice.

Conclusions:

The study underscores the critical role of integrated railway station development in shaping sustainable commuting patterns and spatial structure within metropolitan regions. Effective outcomes depend on the alignment of transport investments with land-use planning, institutional coordination across jurisdictions, and the implementation of multimodal accessibility strategies. The findings support a paradigm shift in Romanian metropolitan planning toward polycentric development models, where railway nodes function as catalysts for compact, mixed-use urban growth. This research contributes to the broader discourse on sustainable urban mobility by providing empirical evidence from a post-socialist context undergoing rapid metropolitan transformation.



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sciforum-173583: Comparative Analysis of Formal and Informal Transportation on Arterial Roads in Metropolitan Lima

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Nowadays, mobility between districts in Metropolitan Lima (from San Miguel to San Isidro) is complex and presents difficulties due to the inefficiency and saturation of the formal public transportation system. The main problem is that bus corridors operate overcrowded during peak hours, bus stops are congested, and routes are rigid. As a result, people resort to informal minivans or shared taxis to reduce their travel time. Thus, informal or “pirate” transport emerges as a rapid solution to the shortage of sufficient formal corridors.

This research develops a comparative analysis between formal and informal transportation along Avenida La Marina at the intersections with Avenida Universitaria and Avenida Brasil. The study consists of conducting counts over periods of 15 to 20 minutes to record the number of minivans and corridor buses, as well as the number of passengers who prefer each service. In addition, the routes used by each type of transport are documented, and a statistical table is generated based on the collected data and surveys conducted.

The results demonstrate that informal transportation is significantly more prevalent than formal transportation, especially during peak hours. Through the counts, it is verified what percentage of users chooses minivans over corridor buses. The study concludes that minivans maintain faster connectivity between these two districts compared to formal transport.

This research aims to provide evidence for authorities, such as the Ministry of Transport, to recognize that although formal transport is safer, it does not meet current demand. The solution is not to prohibit informal transport, since statistics show that minivans reduce travel time and serve as an alternative to the lack of sufficient corridors, but rather to develop a new transportation system that complements these services while remaining formal.



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sciforum-174299: Corridor-Level Congestion Analysis and Critical Path Network Optimization for Urban Mobility Improvement: The Case of Nagpur

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Rapid urbanization and rising private vehicle ownership have intensified traffic congestion in Tier-2 Indian cities such as Nagpur. The Comprehensive Mobility Plan (CMP-2025) identifies major Origin-Destination (OD) corridors with high Passenger Car Unit (PCU) volumes experiencing recurrent congestion, indicating the need for systematic assessment and planning interventions. This study evaluates traffic congestion levels, traffic flow behaviour, and the key causes of congestion across selected priority corridors in the Nagpur Metropolitan Region, with a focus on route reallocation as a decongestion strategy.

The methodology integrates primary data from classified traffic volume counts, speed-delay studies, and route-choice surveys with secondary data from CMP reports, RTO records, and GIS-based road network layers. Congestion severity is assessed using Volume-Capacity (V/C) ratio, Level of Service (LOS), and Travel Time Index (TTI). Spatial analysis using GIS is employed to identify bottleneck locations, while traffic flow behaviour is examined through fundamental traffic flow relationships and peak-hour variability.

Results show that one of the critical corridors generates approximately 76196 peak-hour passenger trips, with the corridor Humpyard Road carrying the highest demand. Congestion is primarily attributed to the absence of service lanes, constrained right-of-way, dominance of two-wheelers in work trips, and poorly integrated land-use patterns. Peak-hour travel speeds across most corridors remain below 30 km/h, with signal delays contributing significantly to travel time losses, indicating scope for signal optimization and route reallocation.

The study reveals a substantial mismatch between road capacity and traffic demand, exacerbated by roadside parking, geometric deficiencies, encroachments, and inefficient traffic management. Route reallocation, combined with targeted traffic management and signal improvement measures, is proposed as an effective short-term strategy for reducing congestion. The research offers a structured framework for congestion assessment and provides evidence-based planning recommendations applicable to similar urban contexts.



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sciforum-175109: Differentiated Effects of Public Transport Accessibility on Park Utilization: Evidence from Crowdsourced Data in Singapore

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Parks provide essential health and environmental benefits in cities. Park utilization refers to the extent to which residents use parks for recreational activities. It is substantially influenced by public transport accessibility. Existing research examines this relationship as a single outcome without distinguishing effects across different utilization types. This study investigates the differentiated effects of public transport accessibility on park utilization across Singapore. We integrated public transport stop data, park characteristics, and crowdsourced mobility data. Public transport accessibility was measured by stop density and nearest stop proximity within 500 m catchments around parks, differentiated by transport mode. Park utilization was quantified along two dimensions: routine utilization intensity, derived from GPS activity traces, and organized utilization frequency, identified from geotagged social media imagery using computer vision. Hotspot analysis and regression modeling at the park and district levels examined the effects of transport accessibility on each dimension. At the park level, higher public transport accessibility significantly predicted organized utilization frequency but not routine utilization intensity. Routine utilization was instead associated with park characteristics such as trail network density. At the district level, central and eastern districts formed significant utilization hotspots, while peripheral districts with limited transport accessibility showed persistent underutilization. These findings reveal that public transport accessibility selectively enables park utilization, with a stronger effect on organized than routine utilization. This distinction suggests that accessibility assessments in urban transport planning should account for different utilization dimensions to develop more targeted strategies for enhancing equitable and effective park utilization.



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sciforum-172528: Dimensions of Compact Urban Form and CO₂ emissions from Transport in Indian Cities

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Compact urban development is preferred as a central strategy for promoting sustainable urbanization worldwide. By facilitating shorter trip lengths, reduced travel demand, and promoting public transit facilities, compact urban development is widely associated with lower CO₂ emissions from transport. However, urban compactness has been mostly equated with high density, overlooking other spatial characteristics of compactness that shape travel pattern and emission outcomes. This study revisits the compact city paradigm by defining compactness through multiple spatial dimensions and examining their association with CO₂ emissions from transport in 28 Indian cities. Five dimensions of compactness—density, shape, contiguity, spatial concentration and fragmentation—are quantified using Landsat data. Spatial metrics are calculated using ArcGIS Pro and Fragstats. A two-step analytical framework is adopted to assess the relationship between dimensions of compactness and related emissions. An ordinary least squares (OLS) regression model with heteroskedasticity-consistent (HC3) standard errors examined linear effects, and a Random Forest model with leave-one-out cross-validation evaluated nonlinear patterns and verified the relative importance of each dimension. The results indicate that fragmentation is the strongest positive influencer of per-capita emissions, with spatially discontinuous urban growth considerably increasing CO₂ emissions from transport. In contrast, contiguity and spatial concentration exhibit strong negative correlations with emissions, showing that spatially aggregated development patterns reduce emissions. Density and shape compactness have negative but moderate impacts. The Random Forest analysis supports the relative importance ranking observed in the regression results. These findings imply that reducing fragmentation and strengthening contiguity and concentration could achieve greater emission reductions than increasing density alone. For rapidly urbanizing Indian cities, policies that encourage connected and concentrated compact urban developments are crucial for low-carbon mobility transitions. Future research could integrate inter-city connectivity and network centrality perspectives to better capture multi-scalar influences on transport CO₂ emissions.



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sciforum-174219: Energy-Aware Urban Management for Smart Mobility: Coordinating Transport Operations, Edge Computing, and Public Value

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Smart mobility is often evaluated through congestion and travel-time indicators, yet urban transport operates within a coupled system in which digital infrastructure and energy objectives increasingly shape operational decisions. As electrification expands and cities report carbon outcomes alongside service reliability, the interaction between traffic management and energy performance becomes more visible. Data-driven control may reduce energy use indirectly by stabilising speeds, reducing stop-start driving, and improving bus reliability. However, sensors, communications, and cloud-edge systems consume power continuously, and their lifecycle costs are rarely incorporated into transport energy assessments.

This study conceptualises city-scale intelligent transportation platforms as energy-aware urban service systems and examines how energy considerations are embedded in management practice. A comparative case-study approach is applied to Hangzhou, Singapore, and Kuala Lumpur, where different governance logics have shaped the scaling of data-driven operations. Evidence is drawn from policy documents, implementation reports, and peer-reviewed literature, with attention to indicator definitions, baselines, and reporting scope.

Simulation experiments conducted on a representative metropolitan traffic network demonstrate that the proposed framework reduces overall transportation energy consumption by 21.4%, decreases average vehicle travel time by 17.8%, and improves traffic flow stability by 23.6% compared with conventional cloud-based mobility management systems. Furthermore, the system increases public transit utilization by 14.2% and reduces CO₂ emissions by approximately 18.5% through improved route coordination and congestion mitigation. These results indicate that integrating edge intelligence with energy-aware transport management can significantly enhance the sustainability, resilience, and public value of next-generation smart city mobility infrastructures. The findings suggest that differences in reported outcomes are closely linked to governance structures and evaluation frameworks, while metric heterogeneity and limited benchmarking constrain cross-city comparability.



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sciforum-172603: Equitable Transport Resilience to Urban Flooding

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Introduction:

Flooding increasingly disrupts everyday mobility in coastal cities, yet transport restoration is often assessed only in technical terms. Experience from recurrent flood events in Chennai shows that reopening roads and transit routes does not ensure equitable access. Low-income households, informal workers, women, the elderly, and persons with disabilities often face longer disruptions and higher recovery burdens. While most studies emphasise response and recovery, resilience is also shaped by mitigation and preparedness measures such as risk reduction planning, evacuation training, and institutional readiness. This study examines whether post-flood transport recovery is not only resilient but also equitable within the broader risk management cycle.

Methods:

The study develops an equity-centred framework integrating four resilience dimensions (robustness, redundancy, rapidity, and resourcefulness) with three justice dimensions (distributional, procedural, and recognition), across mitigation, preparedness, response, and recovery phases. A mixed-methods approach combines field observations, commuter and household surveys, mapping of informal mobility systems, stakeholder consultations, and spatial analysis. Indicators are standardised to generate a Resilience Index (RI), a Justice Index (JI), and an integrated Equity-Resilience Integration Index (ERII). Ward-level analysis identifies mismatches between system performance, preparedness capacity, and lived mobility experiences.

Results:

Findings reveal uneven recovery patterns. In several areas, infrastructure functionality returned quickly, yet vulnerable groups continued to face access barriers. Locations with weak preparedness—such as limited evacuation planning, low awareness, and poor institutional coordination—experienced prolonged disruptions. Informal and community-led mobility systems played a critical role in maintaining connectivity but remain under-recognised in formal planning.

Conclusions:

Evaluating resilience through a justice lens across the full risk management cycle exposes gaps overlooked by conventional metrics. The ERII framework provides a practical tool for integrating mitigation, preparedness, response, and recovery, supporting more inclusive and equitable transport recovery in flood-prone coastal cities.



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sciforum-153795: Evaluating Ridership Forecast Accuracy in Indian Urban Transit Projects Using MAPE and Regression Analysis

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Urban transport systems in India are undergoing rapid transformation, with significant investments in metro rail, Bus Rapid Transit (BRT), and related infrastructure. Despite these investments, the performance of several systems has consistently fallen short of expectations, resulting in considerable economic, social, and financial implications. A key contributing factor is the persistent overestimation of ridership forecasts in Detailed Project Reports (DPRs), which undermines the long-term viability of these projects.

This study critically evaluates the performance of operational metro, BRT, and Intermediate Public Transport (IPT) corridors using a Projected vs. Achieved Performance framework. The magnitude of forecasting error is first quantified using the Mean Absolute Percentage Error (MAPE), which reveals an average forecast bias exceeding 1500% in newly operational metro systems, highlighting the scale of the planning discrepancy.

To investigate the underlying causes of this bias, a Multiple Linear Regression (MLR) model is employed to examine the relationship between achieved ridership and key planning variables commonly used in DPR forecasts, including income levels, network expansion, and modal competition. The results indicate that the forecasting bias is significantly associated with an overestimation of the effects of network expansion and a systematic underestimation of competition from Intermediate Public Transport (IPT).

A comparative analysis of high-error and low-error projects further provides insights into the structural limitations of existing forecasting practices. Based on these findings, this study proposes data-driven recommendations for adopting more robust, econometrically grounded, and locally adaptive forecasting methodologies, which are essential for improving the sustainability and planning effectiveness of future urban transit investments in India.



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sciforum-172767: Evaluating the accessibility of public transit stations for the elderly: Toolkit development and application

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Public transit infrastructure is essential to ensure the mobility of the elderly, enabling them to travel efficiently for various purposes such as recreational and medical. However, although the phenomenon of rapidly ageing communities has become a global problem, the public transport infrastructure is yet to be fully adapted in several countries to cater for the needs of these growing users, thus leading to accessibility issues. It is therefore essential to devise appropriate tools to assess the conditions of the existing infrastructure and ultimately devise appropriate measures.

This study was conducted using the newly built Light Rail Transit (LRT) network in the urban areas of Rose Hill and Quatre Bornes in Mauritius as case studies. Following a comprehensive literature review, it was deduced that the accessibility at transit stations is dependent on three main factors, namely, quality of pathway, security, and furniture present. A toolkit consisting of these three major parameters and sub-components was developed to rate the accessibility of transit stations in the selected study area using a walk over survey. The results of the toolkit were used to calculate the scores of three LRT stations in the study area and demonstrated using spider charts.

Our findings indicate that the infrastructure at LRT stations satisfied several accessibility criteria for the elderly in terms of good surface quality and continuity of footpath, adequate street lighting, provision of furniture such as benches and shelters, and cleanliness. However, they fared poorly in terms of kerb height, presence of various obstructions along the pathway and the lack of priority crossings. The findings highlight that although public transport infrastructure is being built to high standards, additional consideration can be given during the planning and design phase to specific aspects to better cater for the mobility needs of elderly pedestrians.



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sciforum-169717: Evaluating Transit Corridors for a Contextual Mass Transit Model in Baguio City

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Highland cities like Baguio face unique transportation challenges due to complex topography, hazard exposure, and increasing demand, yet there is limited empirical guidance on designing context-specific mass transit systems. This study aims to identify the most suitable corridor locations in Baguio City for implementing an effective urban transportation model. Using a mixed-methods approach, the research combines GIS-based terrain and hazard analyses, demand estimation, and passenger surveys to evaluate three key corridors—Marcos Highway, Naguilian Road, and Loakan Road—based on their topography, safety, demand, and operational viability. Indicators such as slope feasibility, stop catchment demand, and hazard avoidance were used to assess the suitability of each corridor for different modes of mass transit. The findings show that Naguilian Road accommodates the highest demand but has moderate hazard exposure, while Marcos Highway offers better safety and reliability with lower demand. Loakan Road, characterized by steep grades and hazard-prone terrain, presents significant challenges for fixed-guideway systems but remains critical for access to hillside communities. Based on these insights, a “BRT-lite plus feeder” network is proposed, emphasizing corridor-specific infrastructure improvements, hazard-informed station siting, and operational enhancements such as priority treatments and real-time dispatching. The recommended model aims to optimize demand, improve safety, and enhance service reliability within the city’s geographic constraints. This research contributes to urban mobility planning by demonstrating how tailored, data-driven corridor assessments can inform the development of practical, context-sensitive mass transit solutions for hazard-prone highland cities.



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sciforum-175945: GIS-Based Mapping of Slope-Dependent Energy Consumption and Recovery for Sustainable E-Bike Mobility

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In the post-COVID-19 period, urban mobility patterns have changed significantly, making micromobility systems, particularly e-bikes, increasingly important for short-distance and last-mile travel. As the role of e-bikes in urban transportation continues to expand, energy efficiency has become a key issue affecting battery performance, operational feasibility, and the broader sustainability of micromobility systems. Among the factors influencing e-bike energy use, topography, especially road slope, is a key determinant of consumption and recovery potential.

This study presents a GIS-based framework for modelling slope-dependent energy consumption and regenerative energy recovery across an urban road network. Rather than relying solely on average energy values for the entire network, the study calculates segment-based consumption, recovery, and net energy indicators. It visualizes them as layered thematic maps in a GIS/Folium environment. This approach reveals the spatial heterogeneity of energy patterns and helps identify critical segments and corridors where short but steep transitions may generate disproportionately high energy costs.

The findings show a clear spatial relationship between slope and energy performance. The resulting net energy maps enable the identification of energy-advantaged and energy-disadvantaged parts of the network, thereby providing a more detailed understanding of urban topographic effects on micromobility systems. These outputs can support municipalities, micromobility operators, and urban mobility planners in developing more informed, place-sensitive, and energy-aware strategies for sustainable transport.

Although the framework is based on simplifying assumptions, excludes traffic-related operational conditions, and is limited to a single study area with constrained validation, it provides a practical basis for integrating topography-sensitive energy analysis into sustainable urban mobility planning.



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sciforum-172711: IOT-BASED ROADSIDE SMART PARKING SYSTEM

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Growing vehicle density and insufficient parking facilities have made urban parking management increasingly challenging. Drivers often waste valuable time circling in a futile search for parking, which results in wasted gas, traffic congestion, and pollution. To mitigate these concerns, the proposed research presents an Internet of Things (IoT)- supported smart parking system that will automate and manage parking spaces in real time. The proposed system includes a microcontroller-based control unit that serves as the system's main processing unit. The control unit continuously monitors the occupancy status of each parking space using sensors to classify whether each space is empty or occupied. With the help of a specialized website, users can see parking space availability in real time and reserve parking in advance. The user opens the website and books a slot of their choice. Immediately after booking, an Entry OTP is generated and stored in Firebase. The user receives this OTP, which must be entered at the parking keypad within the 10-minute grace period. When the user decides to leave, the system calculates the total time spent based on the entry and current timestamps. The website displays the total payable amount (for example, ₹50/hour). Once the user completes the online payment, the system automatically generates a unique Exit OTP and sends it to the user. The user enters the Exit OTP on the keypad module. Upon validation, the servo motor opens the exit gate. The slot status is updated to Available, and the exit timestamp and payment confirmation are stored in Firebase. This control unit connects directly to the internet; therefore, there is no reliance on intermediate hardware to connect to the internet. The hardware saves user/consumer time and costs during implementation, improving the user experience.



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sciforum-172708: IoT-Based Smart Parking System with CNN Technology and Piezoelectricity Technology

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The rapid expansion of the city's population, together with the increase in vehicles, has made vehicle parking a major problem today. These days, finding a parking slot is time-consuming, and there is no safety for the vehicle. To address these limitations, we have created a smart parking system that includes a webpage to see the available slots. From this web interface, the user can book a slot and make a payment. ANPR technology for number plate recognition and piezoelectric technology to generate electrical energy for backup. This system uses IR sensors that detect vehicles in the slots and update the data on the webpage using the cloud-based ESP32 Devkit microcontroller. The microcontroller sends data to the Flask-based backend, where it is stored and managed in the PostgreSQL database. This paper uses Automatic Number Plate Recognition (ANPR) with cloud-based Convolutional Neural Network (CNN) technology for vehicle identification and protection. Additionally, this project includes a piezoelectric system to generate electrical energy. Electrical energy is generated by the mechanical pressure of a vehicle passing through the piezoelectric sensor. This proposed solution provides budget-friendly, expandable parking operations and efficient parking management.



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sciforum-172687: IoT-based SmartParking System integrated with Face Recognition for vehicle access control

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Abstract

Urbanization and the rapid increase in vehicle ownership have intensified parking challenges, leading to congestion, wasted time, fuel consumption, and unauthorized access in public and private facilities. Traditional parking systems relying on manual supervision and paper tickets are inefficient and prone to errors. To address these issues, this project proposes an **IoT-based Smart Parking System integrated with Face Recognition for vehicle access control**. The system employs an **ESP32-CAM** to capture and authenticate the driver's face against a registered database. Authorized users gain seamless entry through a servomotor-controlled gate, ensuring enhanced security. Parking slot detection is achieved using an **IR sensors**, which continuously monitor occupancy and updates availability in real time. This data is transmitted via WiFi to a cloud platform such as **Firestore**, enabling remote monitoring and management through a website dashboard. The methodology follows a structured workflow: vehicle detection at the entrance, face capture and recognition, automated gate control, slot occupancy detection, cloud synchronization, and real-time display of parking status. A field survey conducted among drivers, students, and parents confirmed the pressing need for such automation, highlighting delays and inefficiencies in conventional parking systems. This integrated solution leverages **IoT and sensor technologies** to deliver secure, efficient, and user-friendly parking management. It reduces waiting time, prevents unauthorized access, and optimizes space utilization. The proposed system is highly adaptable for deployment in **offices and apartments**, contributing to sustainable urban mobility. By combining intelligent sensing, cloud connectivity, and biometric authentication, the project demonstrates a scalable model for next-generation parking systems that enhance convenience, security, and operational efficiency in modern urban environments.



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sciforum-172645: Portrait of the Ambulatory Disabled in Philadelphia

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Introduction: Philadelphia has one of the highest disability rates of all large US cities. The 1990 American with Disabilities Act decreased disparity between nondisabled and disabled Philadelphians. However, ongoing geographic segregation of resources needed by disabled communities illustrates the work remaining to make Philadelphia more equitable. This presentation outlines areas of geographic segregation in the Philadelphia ambulatory disabled community and how they overlap with community resources.

Methods: To examine the social context of disability in Philadelphia, we employed Geographic Information Systems (GIS). GIS enables spatial analysis of population-level data. Data sources included the U.S. Census Bureau (American Community Survey 5-Year Estimates) for demographic and socioeconomic variables at the census tract level. OpenStreetMap and City of Philadelphia GIS Hub provided spatial layers for public infrastructure. Philadelphia Department of Public Health provided data on neighborhood health centers. The Septa public transit web portal provided data on accessible transit stations. Proximity to grocery outlets and overlay with food deserts was obtained from the USDA food access research atlas. Choropleth mapping was used to visualize the spatial distribution of each variable. Hot spot analysis was used to identify statistically significant clusters of disability prevalence. Spatial autocorrelation was used to assess the degree of clustering.

Results: The ambulatory disabled population of Philadelphia is geographically disproportionately segregated into census tracts with high rates of poverty and limited access to accessible transit stops, usable sidewalks, community health clinics, and grocery outlets. Northeast Philadelphia has amongst the highest rates of ambulatory disabled populations and lacks access to many critical community resources.

Conclusion: The ambulatory disabled population of Philadelphia is geographically segregated into census tracts with limited access to necessary community resources. Insight into the geospatial distribution of disabled communities and its relation to community resources will allow more informed public policy decisions on resource allocation and planning.



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sciforum-172746: Prediction of Synergic Effect of Walkability and Carbon Readiness to Promote Sustainable Mobility in an Industrial Township

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Planned industrial townships were historically designed with compact neighborhoods, functional land-use distribution, and strong internal accessibility; however, rising private vehicle dependence and spatial dispersion are weakening their inherent pedestrian orientation. Prior studies on sustainable mobility in such settlements have primarily examined walkability, urban form, or low-carbon transport transitions in isolation. The interactive or synergic relationship between pedestrian-supportive environments and carbon transition readiness—defined as the spatial and infrastructural capacity to enable low-emission mobility—remains insufficiently understood, particularly in industrial township contexts.

This research proposes an integrated predictive framework to evaluate how walkability and carbon readiness jointly influence sustainable mobility potential. Composite indices are constructed using primary travel behavior surveys, pedestrian environment assessment, and spatial metrics including connectivity, land-use proximity, density, and modal accessibility. Multi-criteria aggregation and spatial overlay analysis are employed to identify convergence zones where pedestrian-friendly morphology coincides with high readiness for low-carbon mode adoption. Scenario-based testing further estimates the potential shift of short motorized trips toward non-motorized and public transport modes under targeted improvement strategies.

The results demonstrate that areas exhibiting both high walkability and carbon readiness present disproportionate opportunities for reducing short-distance motorized travel and associated emissions. By linking urban form characteristics with transition readiness, the study advances an integrated methodological approach for planning sustainable mobility in industrial townships. The framework offers decision-support for prioritizing pedestrian-oriented and low-carbon mobility interventions in similar planned industrial settlements undergoing motorization transition.



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sciforum-172651: QR CODE BASED PARKING SYSTEM WITH ALARM AND NAVIGATION

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The rapid increase in the number of vehicles in urban areas has led to significant challenges in parking management, including traffic congestion, fuel wastage, and driver inconvenience. This paper presents a Smart Parking System with web application support, implemented as a prototype using Internet of Things (IoT) technologies, to improve parking efficiency and user experience in urban environments.

The proposed system enables users to view real-time parking availability and reserve parking slots through a web-based interface, thereby reducing the need for manual searching. Each parking slot is equipped with ultrasonic sensors that detect vehicle presence. These sensors communicate with an ESP32 microcontroller, which processes the data and updates a cloud-based database to ensure accurate and real-time parking information.

To evaluate parking demand, the system considers real-time occupancy data, frequency of slot usage, and peak-hour variations, which provide insights into urban parking patterns. This data-driven approach can be extended using Transport System Models (TSM) to predict demand and optimize parking allocation. Furthermore, the integration of Information and Communication Technology (ICT) with TSM enables intelligent decision-making and scalable urban mobility solutions.

Additionally, the system incorporates a wrong-parking detection mechanism that triggers a buzzer alert and sends notifications through the web application when improper parking is detected. The proposed system demonstrates a practical, scalable, and cost-effective solution for smart urban parking management.



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sciforum-179697: Real-Time Classification of Power Quality Disturbances using 1D CNN on Raw Signal: Noise Robustness and Monitoring into a Smart City

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This paper addresses the problem of detecting and classifying power quality disturbances in modern urban networks, an essential aspect for the reliable operation of critical infrastructures. In the context of smart cities, where energy systems support public transport, digital infrastructure and urban services, power quality monitoring becomes a key factor for operational continuity and performance. The main objective of this work was to develop and evaluate an artificial intelligence-based framework for the automatic identification of the main types of disturbances: voltage sags, voltage swells, harmonics and transients. To this end, simulated signals with varying levels of Gaussian noise and overlap between classes were generated to reproduce realistic operating conditions. Three classification methods were compared: (i) a one-dimensional convolutional neural network (1D-CNN) trained directly on the raw signal, (ii) a multilayer perceptron based on extracted features such as RMS value and total harmonic distortion, and (iii) a Support Vector Machine classifier. The results show that the 1D-CNN model offers superior performance and high robustness to noise, maintaining high accuracy even under conditions of significant signal degradation. In addition, it allows for efficient detection of short-duration transients without requiring manual feature extraction. The main contributions of the paper include (1) the direct use of the raw signal for classification, eliminating intermediate processing steps; (2) the systematic evaluation of performance based on the signal-to-noise ratio; (3) the integration of a “2-of-2” decision logic to stabilize the results in real-time monitoring scenarios; and (4) the analysis of the model interpretability by visualizing the internal activations. The paper is addressed to electricity grid operators, smart infrastructure solution providers, local authorities, and researchers in the field of signal processing and machine learning. The results demonstrate that the proposed approach can contribute to the development of scalable and reliable systems for power quality monitoring, with direct applications in the management of modern urban infrastructures.



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sciforum-172567: Spatial disconnectivity: Singapore's perspective on cycling

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Cycling plays an increasingly important role in sustainable urban mobility, offering benefits such as reduced carbon emissions, traffic decongestion, recreational opportunities and improved public health. This is aligned with Singapore's city-in-nature concept and our commitment to car-lite options in the Singapore Green Plan with an expansion to 1300km park connectors, fulfilling Sustainability Development Goals 11 and 13. Despite expansive measures, less than 2% of residents cycle to work, signalling a need to move beyond isolated infrastructural interventions. This research aims to synthesise evidence of fragmented cycling infrastructure, highlighting a spatial mismatch, and explore how park connector design and accessibility influence cycling habits, encouraging active mobility opportunities in daily commutes.

Utilising Geographical Information Systems (GIS) data to spatially map cycling infrastructure across 12,877 HDB residential flats in 55 planning areas, I aim to integrate various access-to-cycling-infrastructure indices for each flat and aggregate the flat-specific metrics to the town level to assess residential access to cycling infrastructure. This highlights that cycling facilities are clustered in the Northeast and Northwest regions, leaving residential towns with inconsistent links to recreational and commuting routes. Additionally, fragmented connections, inconsistent end-of-trip facilities, and bottlenecks at intersections increase collision risks, reducing safety and providing inconvenient cycling experiences, discouraging active mobility. This shows a failure to close the mobility loop, as inconvenient commutes deter residents towards car-lite options. As such, I plan to identify systematic spatial gaps in connectivity, particularly in HDB towns with complex road layouts or missing cycling links and highlight the need to move beyond green corridor expansion, prioritising the connectivity of cycling pathways.



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sciforum-172763: Sustainable Urban Mobility Transformation in Gwalior: Integrating Smart Infrastructure and Low-Emission Transport Systems

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Transportation sector pollution is one of the most critical environmental challenges affecting urban sustainability, public health, and occupant comfort in rapidly growing cities. This paper analyses the factors of the urban mobility, using an in-depth evaluation of the urban traffic flow, modal share, vehicle composition, and the emission loads as a basis of proposing the innovative and data-driving approaches in accordance with the principles of sustainable transportation. The Traffic Volume Count survey for Gwalior, India shows that it has a large daily vehicular capacity of well more than 155,000 vehicles with two wheelers and intermediate public transport (IPT) as the major modes of transportation. The proportion of short-range (≤ 5 km) trips (> 50 percent of daily trips) indicates a huge potential of the modal shift on active mobility and the integration of the public transit. Average journey speeds ranging between 22–27 km/h highlight systemic congestion and operational inefficiencies. Nevertheless, infrastructure fragmentation, poor pedestrian infrastructure, and the lack of transit-centered planning are the current limitations to the adoption of sustainable mobility.

The paper focuses on TOD and the corridor-based planning to reorganize the patterns of growth around high capacity public transport corridors. The introduction of electric intra-city buses and the electrification of IPT fleets facilitates the low-emission mobility transitions. It is suggested that smart infrastructure (e.g. ITS, digital fleet management systems, GPS-based tracking) can improve operational efficiency and minimize the emissions associated with the idling issue.

Promotion of active mobility is a key component of the strategy. The continuous footpath, cycle tracks, safe last-mile connectivity are geared towards promoting local walking and cycling to make short journeys. These solutions decrease vehicle kilometers traveled as well as enhancing accessibility, inclusivity, and population health.



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sciforum-159602: The Geometry of Delay: Assessing Route Tortuosity and Systemic Inefficiency in Jakarta's BRT Network

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Jakarta, Indonesia, hosts the world's longest Bus Rapid Transit (BRT) system, yet the network faces persistent challenges in temporal competitiveness. This study evaluates the spatiotemporal performance of this extensive network by analyzing the General Transit Feed Specification (GTFS) data of 243 unique routes, encompassing both BRT trunk lines and "Mikrotrans" feeder layers. The proposed framework is designed for universal scalability, utilizing city-agnostic metrics derived from complex network graph modeling. The methodology calculates Betweenness Centrality for node importance, while the Tortuosity Index (τ) is employed to quantify spatial sinuosity, with specialized logic to account for high-circuitry loop services. Operational efficiency is further assessed through advanced numerical evaluations, including a Time Penalty Ratio against an idealized urban speed baseline and a novel Operational Waste Index (OWI) that correlates route sinuosity with service frequency. The analysis reveals a near-perfect correlation (0.99) between route tortuosity and scheduled delays, suggesting that temporal performance is fundamentally embedded in geometric design. While the primary BRT corridors maintain linear efficiency, 43% of the network, predominantly feeder services, exhibits significant circuitry (τ 1.5" data-index-in-node="1325"> > 1.5). By identifying a critical subset of systemic bottlenecks where high network centrality coincides with excessive tortuosity and high node density, this study highlights a strategic trade-off between maximizing spatial coverage and maintaining operational speed. These insights provide a scalable, data-driven framework for "Strategic Straightening" and network restructuring in megacities seeking to optimize first/last-mile connectivity



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sciforum-166214: Urban Informatics for Multimodal TOD Diagnostics: GeoAI-Enhanced Node–Place–Design Assessment of Rail and Bus Transit Nodes in Sri Lanka’s Western Province

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Transit-Oriented Development (TOD) is a cornerstone of sustainable urban planning. Yet, operationalizing TOD requires urban science methods that integrate heterogeneous spatial data, quantify multidimensional performance, and reveal system-wide patterns. From a complexity-informed perspective, station areas function as complex adaptive systems where accessibility, land use, walkability, and socio-demographic demand co-evolve. In Sri Lanka's Western Province—where railway stations and major bus terminals structure everyday mobility—TOD decisions are often constrained by transport-centric frameworks and simplified indicators that insufficiently represent multimodal realities and rapid urban change.

This study develops an urban informatics pipeline—integrating big-data, sensing, and computing—to diagnose TOD potential across 92 railway stations and 25 major bus terminals using a GeoAI-enhanced Node–Place–Design framework. The Node–Place Model provides the core analytical theory for assessing the balance between transportation performance (node) and surrounding development intensity/function (place), and is extended with a design dimension to better capture pedestrian accessibility and built-form conditions around transit areas. The assessment integrates 39 indicators operationalized under the 7D TOD principles (Density, Diversity, Design, Destination Accessibility, Distance to Transit, Demand Management, and Demographics). Indicators are normalized, weighted using an entropy-based scheme, and aggregated into a composite TOD index for each node. K-means clustering classifies transit areas into TOD typologies and identifies node–place mismatches (e.g., strong node/weak place). At the same time, an XGBoost model estimates the influence of indicators to highlight priority levers for intervention.

Results reveal substantial spatial variation and persistent imbalances between accessibility and development across the multimodal network, indicating where integrated station-area planning and targeted investments could unlock underutilized transit capacity and support sustainable, equitable urban growth. Theoretically, the study advances urban science by translating a complexity-informed, multimodal Node–Place–Design model into scalable, testable diagnostics; practically, it provides evidence-based typologies and policy levers to target station-area interventions, coordinate land-use–transport integration, and prioritize investments.



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sciforum-175353: Urban Mobility, Demographic Change, and Spatial Mismatch in African Cities: Rethinking Transportation and Inclusive Development.

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Africa's rapid demographic transformation characterized by a youthful population, accelerated urbanization, and expanding metropolitan regions—has intensified pressures on urban mobility and transportation systems. This study examines how these demographic shifts contribute to growing spatial mismatch in the African cities of Accra, Lagos, and Nairobi. These cities face increasing strain on transport systems, infrastructure, and spatial planning, resulting in significant inequalities in access to opportunities. Drawing on spatial mismatch theory and mobility justice frameworks, the study explores how the geographical separation between residential areas and employment centers, combined with weak and fragmented transport systems, deepens socio-economic exclusion. Through document analysis of World Bank and UN-Habitat reports, household travel surveys, and related reports, the study adopts a comparative case study approach to identify patterns in transport systems such as trotro, matatu, and danfo. While these systems play a central role in urban mobility, they remain unreliable and poorly integrated into formal urban planning structures. The study concludes that achieving inclusive urban development requires a shift toward integrated, equitable, and sustainable transport policies, alongside investments in mass transit that prioritize vulnerable populations and support rapidly growing urban populations. It further contributes to urban theory by extending spatial mismatch to global contexts, demonstrating that mobility inequality is central to understanding urban governance, labor market access, and inclusive development in rapidly urbanizing African cities.



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sciforum-172704: Urban Road Infrastructure Detection in Sofia Using Spatial–Spectral Fusion of Computational Algorithms and Sentinel-2 Multispectral Imagery

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Urban road infrastructure plays a fundamental role in the functionality, accessibility, and resilience of contemporary cities, supporting transportation systems, economic activity, emergency response, and strategic urban planning. Accurate and up-to-date spatial information on road networks is therefore essential for infrastructure monitoring and sustainable urban development. Although multispectral Earth observation imagery offers significant potential for large-scale road detection due to its spatial coverage and spectral sensitivity, reliable extraction of urban road features remains challenging because of spectral variability, heterogeneous surface materials, shadows, and the structural complexity of densely built environments.

This study proposes a spatial–spectral computational framework for the detection and delineation of urban road infrastructure using multispectral satellite imagery. The analysis is based on data acquired from the Sentinel-2 mission over Sofia, Bulgaria. The dataset provides multi-band reflectance information with consistent spatial resolution and temporal availability, enabling detailed assessment of urban surfaces and infrastructure patterns.

The methodology integrates spatial feature extraction and spectral-based classification within a unified processing workflow. The main stages include preprocessing, extraction of spatial structural features describing linearity and edge continuity, spectral classification of surface materials, and fusion of spatial and spectral outputs for final road delineation. Edge detection techniques such as Canny and SUSAN are evaluated to enhance linear feature identification, while similarity-based classification, including the Spectral Angle Mapper (SAM), is applied for robust discrimination of road-related materials.

The spatial–spectral fusion strategy improves continuity of detected road segments, reduces false positives in spectrally complex urban scenes, and increases mapping robustness. The results demonstrate that integrating computational spatial analysis with multispectral spectral classification significantly enhances urban road detection accuracy and supports transportation monitoring and geospatial decision-making in dynamic metropolitan environments.



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sciforum-165025: Urban Traffic Congestion and Mobility Challenges in Rapidly Urbanizing Cities: Evidence from the Jogeshwari Vikhroli Link Road, Mumbai

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Rapid urbanization in large metropolitan cities worldwide has placed increasing pressure on urban transportation infrastructure, particularly along arterial corridors serving mixed uses and employment-intensive areas. In rapidly commercializing urban precincts, such pressures often lead to recurrent congestion, reduced travel efficiency, and increased pedestrian and vehicle conflicts, with implications for energy use, emissions, and urban sustainability. In this context, the present study assesses the traffic performance of the Jogeshwari Vikhroli Link Road in the Powai area of Mumbai, India, a key urban corridor connecting residential, commercial, and institutional zones to suburban railway stations. A road inventory survey and traffic volume count were conducted to analyze congestion at vehicle stressed nodes and links, including Gandhinagar Junction and the IIT Bombay Main Gate Road. The road inventory survey identified infrastructure deficiencies such as broken footpaths, faded lane markings, and the absence of adequate street hardware and furniture, which intensify pedestrian and vehicle conflicts. Traffic volume analysis revealed that out of 18 road stretches studied, six operate below the Indian average Level of Service C. Notably, the IIT Bombay Main Gate Road recorded a peak traffic flow of 2,307 passenger car units per hour per lane, corresponding to Level of Service E. Based on these findings, this study proposes context-sensitive geometric improvements, street infrastructure provisions, and maintenance measures to mitigate congestion and improve corridor performance. These include lane capacity optimization, installation of street hardware and furniture such as lighting, green buffers, and signage, and rehabilitation of existing infrastructure including kerb stones, lane markings, and pedestrian crossings. Due to the absence of Intelligent Transport Systems infrastructure and limited access to traffic surveillance data, the analysis relies on conventional traffic surveys. The findings nonetheless highlight the potential value of data-driven approaches in future urban mobility assessments.



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sciforum-172809: Walking by Default, Not by Design: Evaluating Non-Motorised Transport Infrastructure Deficits and Transit-Oriented Development Potential along Kitwe's Emerging Dual Carriageway Corridors

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Introduction: In Zambian cities, over 70% of daily trips are on foot or in informal minibuses, yet pedestrians and cyclists account for over 60% of road fatalities, rooted in infrastructure designed for motorised vehicles. Kitwe exemplifies this: residents walk and cycle out of necessity while the built environment provides no dedicated non-motorised transport infrastructure. Meanwhile, corridor investments in Ndola–Kitwe and Kitwe–Chingola dual carriageways reshape connectivity without transit-oriented development, potentially entrenching car-centric spatial configurations in a city where fewer than 10% of households own private vehicles.

Methods: A two-stage methodology is applied. First, a GIS-based walkability and cyclability audit maps existing NMT infrastructure, including footpaths, pedestrian crossings, cycle lanes, and street lighting within two-kilometre catchments of Kitwe's primary arterials and dual carriageway interchanges, scored against the ITDP Pedestrians First framework. Second, a transit-oriented development readiness assessment evaluates land use density, diversity, and design parameters at six interchange nodes using the TOD Standard, benchmarked against modal split data from household travel surveys.

Results: Fewer than 5% of arterial road segments incorporate dedicated pedestrian facilities meeting ITDP minimum standards, and purpose-built cycle infrastructure is absent across the entire surveyed network. Interchange grade separations extend pedestrian crossing distances by 300–800 metres, creating significant severance barriers for non-motorised users. TOD readiness scores remain uniformly low, constrained by single-use zoning, the absence of mixed-income housing near transit nodes, and the lack of scheduled public transport services to anchor development. Copperbelt Province accounts for 15% of national traffic crashes, and total annual economic losses from road injuries reach 4.7% of GDP nationwide.

Conclusions: Kitwe's dual carriageway investments represent a rapidly closing window for NMT and TOD integration. Retroactive pedestrian infrastructure, mixed-use zoning overlays at interchanges, and formalised feeder transit services are essential to prevent reproduction of auto-dependent patterns that undermine mobility equity in resource-constrained cities.



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sciforum-173574: The faster, the less complex: the relationship between vehicle speed and urban complexity in transit streets

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Urban complexity is expressed through the diversity of uses and activities present in public spaces primarily designed for pedestrians. However, contemporary cities have been designed by prioritizing automobile circulation, allowing them to reach high speeds. This condition affects the sense of security and the free use that pedestrians can make of the street, thereby removing its social role and consequently leading to a loss of urban complexity. Therefore, this study proposes that the speed of automobiles is a variable that influences the loss of complexity in the city. The study will be carried out through data collection in sections of avenues with different levels of vehicle flow. In each of these sections, the average speed of automobiles and buses was recorded to obtain a representative value of traffic speed. In parallel, urban complexity in each avenue was calculated using the formula proposed by Shannon, based on Information Theory, which allows quantifying the diversity of activities and urban actors present. In this way, the collected data was related and analyzed through a scatter plot. It was evidenced that streets with higher speeds have lower diversity and social interaction, while those with lower speeds show greater urban activity. This established an inverse relationship between average vehicular speed and levels of urban complexity. The research provides evidence on how urban complexity is shaped by vehicular speed, thereby contributing to the debate on the design and management of street space from an urban perspective that prioritizes pedestrians.



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Session 5. Urban Resilience and Adaptation

sciforum-147282: Heritage, Reuse, and Placemaking: Reframing Circular Urbanism Through Post-Industrial Regeneration

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This study presents a critical and multi-scalar analysis of the adaptive reuse and urban placemaking of an obsolete piece of Parisian railway infrastructure, *Ligne de Vincennes (the viaduct section)*, framing it as a model of post-industrial transformation that integrates cultural vitality, environmental sustainability, and economic regeneration. Through a mixed-methods research design, combining in situ field observation, spatial and architectural analysis, and qualitative data synthesis, the project investigates how the Viaduc's rehabilitation contributes to evolving narratives of urban identity, heritage continuity, and place-based innovation. The Viaduc des Arts, a pioneering example of an inhabited viaduct paired with an elevated linear park, is examined as a paradigmatic case of infrastructural repurposing. The analysis yields ten transferable lessons clustered under six strategic themes: (1) structural and symbolic recovery of viaducts, (2) productive reuse of obsolete transport infrastructure, (3) microclimatic and environmental enhancement, (4) long-term economic return, (5) urban attractiveness and brand identity, and (6) local socio-cultural dynamism. Key enablers of success include the public acquisition and investment strategy, the architectural minimalism and contextual sensitivity of Patrick Berger's design, and the governance model led by Semaest, which ensured the continuity of artisanal vocations within a managed cultural-commercial ecosystem. The project also supports sustainable development goals by conserving embodied energy, reducing demolition waste, and establishing circular economy synergies through the creative reuse of materials and space. By exploring the Viaduc as both a physical and symbolic urban artifact, the study advances a broader framework for post-industrial urban regeneration, highlighting the need to update methodological lenses and planning policies to better align with contemporary challenges in heritage reuse, ecological integration, and spatial equity. The findings serve as a transferable model for cities confronting similar dilemmas of obsolescence, identity, and resilience in the Anthropocene.



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sciforum-161903: Harnessing green infrastructure for urban heat island mitigation:

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The urban heat island (UHI) effect poses a significant environmental and public health challenge, particularly under the accelerating impacts of climate change. Urban green infrastructure (UGI) is widely recognised for its cooling potential; however, its effectiveness in high-density urban environments within extremely cold climate regions remains poorly understood. This study introduces a comprehensive, multi-scale framework to evaluate UHI mitigation strategies by integrating seasonal variability, socioeconomic transitions, and spatial heterogeneity. To operationalise this approach, we focus on Harbin, one of China's largest cold-climate cities, through a longitudinal case study spanning 2000 to 2020. Over two decades, Harbin has undergone rapid urbanisation, demographic shifts, and evolving patterns of green and urban infrastructure deployment, offering a unique context to examine UHI dynamics. Using remote sensing data, climate records, and socio-spatial indicators, the research investigates how urban form and green interventions influence thermal performance across different scales and seasons. The analysis also considers policy changes, economic development, and population growth to understand the interplay between physical and social factors shaping urban thermal environments. Findings aim to provide evidence-based insights for climate-responsive urban planning and policy, emphasising strategies that balance environmental benefits with social and economic priorities. This work contributes to advancing sustainable urban design and resilience in cold-region cities facing complex development pressures and climate adaptation challenges.



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sciforum-160627: Motorcycle Delivery Riders' Safety Compliance: Promoting Urban Social Equity and Resilience in Pakistan's Gig Economy

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Introduction

Motorcycle delivery riders have emerged as a significant social working group within Pakistan's gig economy. These riders play an essential role in ensuring community convenience and supporting local economies. Ensuring their occupational safety is critical as it contributes to broader urban social equity and resilience. However, workers are vulnerable to occupational hazards such as traffic accidents.

Objectives:

This study assesses the compliance of motorcycle delivery riders with Pakistan's helmet usage law, i.e., PMVO 1969, 89-A, as well as to the International Labour Organization's recommended limit of 8 working hours per day.

Methods

A cross-sectional pilot study was conducted among delivery riders working in Islamabad, Pakistan, by using convenience sampling. A structured questionnaire was designed to collect information on participants' demographics, as well as information on helmet usage, working hours, fatigue, and accident involvement. Descriptive statistics such as mean + standard deviation, as well as frequency and percentages, were reported using SPSS version 20.

Results

Based on our findings, only 38% of the participants wore a helmet while driving a motor bike by following Pakistan's helmet usage law, i.e., PMVO 1969, 89-A. The mean daily working duration was 9.1 ± 3.6 hours per day, which exceeded the International Labour Organization's recommended limit of 8 working hours per day. About 36% of respondents experienced at least one road accident. A high proportion, i.e., 35% of the respondents, reported frequent fatigue, reflecting the physical and mental strain associated with their demanding work schedules.

Conclusion

These findings highlight key areas of concern, i.e., poor helmet compliance, extended working hours, and fatigue, may increase the risk of road traffic accidents among riders. Our results emphasize the need for stricter implementation for fostering urban social equity and building resilient city systems.



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sciforum-170342: Multidisciplinary Seismic Vulnerability Assessment of Heritage Urban Centres: From Building Typologies to Urban Resilience

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Historic urban centres concentrate vulnerable building stocks, critical urban functions, and high cultural value within dense, morphologically complex fabrics. Yet, seismic risk assessment still focuses predominantly on single buildings or purely structural indicators, often underestimating systemic vulnerabilities and heritage significance. This contribution proposes a multidisciplinary framework for seismic vulnerability assessment at the scale of heritage urban centres, integrating structural fragility, urban morphology, exposure, and conservation value into a unified, map-based methodology. The approach combines: (i) building-by-building survey and typological classification, (ii) empirical vulnerability indices, (iii) urban-scale indicators such as street network configuration, parcel patterns, and (iv) weighting of cultural significance to support priority setting for risk-mitigation measures. The methodology is applied to a historic city-centre case study located in the western part of Romania, in an area with shallow earthquakes, producing spatial vulnerability scenarios that highlight critical clusters, potential damage distribution across the proposed cultural promenade, and conflicts between structural risk and heritage value. Results show that considering only structural aspects yields intervention priorities different from those when urban configuration and cultural importance are explicitly included, with direct implications for emergency planning and resource allocation. The author argues for closer collaboration between earthquake engineering, architecture, urban planning, conservation, and social sciences, and outlines how such integrated assessments can inform urban policies aimed at enhancing both seismic resilience and quality of life in heritage cities.



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sciforum-175812: Revitalizing Nabao Creek as a Walkable Urban Spine: Applying the B.A.Y.A.N. Framework in Cabanatuan City

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Cabanatuan City, one of the Philippines' prime cities experiencing rapid urbanization, has contributed to the ecological degradation of Nabao Creek, an underutilized urban waterway with considerable potential for environmental restoration and public space activation. This study proposes revitalizing Nabao Creek as a walkable urban spine through the B.A.Y.A.N. Framework, which integrates five key dimensions: Bayanihan (Stakeholder Involvement), Accessibility (Movescape), Yaman Inprastraktura (Blue–Green Infrastructure), Adaptability (Governance and Policy Making), and Nature-Based Solutions. The framework aims to reconnect the waterway with surrounding communities while enhancing ecological performance and public accessibility. Drawing insights from Singapore's Active, Beautiful, Clean (ABC) Waters Programme and the principles of Water-Sensitive Urban Design (WSUD), the research develops a context-sensitive WSUD–BAYAN. This combined framework is tailored to the conditions of rapidly urbanizing Philippine cities. The methodology uses comparative case analysis of international and local precedents to identify transferable strategies in ecological restoration, public space design, and water-sensitive planning. The proposed framework stresses blue–green infrastructure, nature-based solutions, and community- oriented governance to restore ecological functions, improve flood resilience, and encourage inclusive public spaces. By transforming Nabao Creek into a multifunctional ecological corridor, the project demonstrates how neglected waterways can support urban resilience, environmental sustainability, and active public life. Ultimately, the study positions Nabao Creek as a replicable model for sustainable urban waterway revitalization in rapidly urbanizing Philippine cities.



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sciforum-175836: A Multi-Hazard Digital Twin Framework for Climate Adaptation Planning of Interdependent Critical Urban Infrastructure

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Abstract

Introduction:

Climate change is intensifying compound and cascading hazards, including flooding, extreme heat, and drought, posing systemic risks to interdependent critical urban infrastructure such as transportation, water, and energy networks. Although digital twins (DTs) are increasingly adopted for infrastructure monitoring and smart city management, their application remains largely sector-specific and hazard-isolated. A unified, multi-hazard digital twin framework explicitly designed for climate adaptation planning of interdependent infrastructure systems is still lacking. This study addresses this gap by proposing an integrated framework that moves beyond operational monitoring toward strategic adaptation decision support.

Methods:

This research adopts a two-stage methodology. First, a systematic literature review synthesizes advancements in digital twin architectures, climate risk modeling, and infrastructure interdependency analysis to identify existing research gaps. Second, a novel multi-layered digital twin framework is developed. The proposed architecture integrates (i) multi-hazard climate projection scenarios, (ii) infrastructure interdependency network modeling, (iii) dynamic vulnerability and risk assessment modules, and (iv) an adaptation prioritization engine to support strategic planning. The framework emphasizes interoperability, scalability, and real-time data assimilation.

Results:

The review reveals a critical absence of comprehensive frameworks that simultaneously incorporate multi-hazard modeling and interdependent infrastructure dynamics within a unified digital twin environment. The proposed framework addresses this gap by introducing an integrated architecture that enables cross-sector impact simulation, compound hazard scenario analysis, and risk-informed adaptation prioritization within a single decision-support structure.

Conclusions:

This research advances digital twin applications from operational management toward proactive, multi-hazard climate adaptation planning. The proposed framework establishes a scalable and transferable foundation for future prototype implementation and policy-aligned decision-support systems aimed at strengthening urban infrastructure resilience under deep climate uncertainty.



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sciforum-171882: A Participatory Chatbot for Strengthening Urban Flood and Landslide Resilience: Integrating Community Awareness and Planning Decision Support

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Urban communities are facing intensifying risks from floods and other disasters, creating a growing need to connect scientific knowledge with everyday community experience. The continuing increase in anthropogenic activities on the planet has intensified climate change, leading to a higher frequency and severity of natural hazard-related disasters. Digital technological advancements, including monitoring systems that integrate sensors and machine learning, are being implemented in disaster management practices, yielding beneficial outcomes, yet risk communication and preparedness mechanisms remain fragmented across institutions, limiting public literacy, regulatory compliance, and informed development decisions. This study presents a participatory, AI-driven WhatsApp-based chatbot designed to enhance urban adaptive capacity by translating institutional hazard knowledge into actionable, location-specific community guidance. The methodology is grounded in a hybrid architecture that combines a user-centred design approach, with a modular multi-agent system. Additionally, the architecture integrates a collection of modular agents: a language agent facilitating multilingual interaction, an API agent providing live weather updates, and a scheduler agent. Moreover, the system design is supported by measures for overall performance, including response speed, retrieval confidence, language detection accuracy, and system dependability. A full expert review will be undertaken for planning and engineering professionals to systematically assess the relevance, accuracy, understandability, and comprehensiveness of the responses from the user's perspective. For planners and developers, this chatbot supports risk-sensitive zoning interpretation and decision-making, contributing to improved regulatory adherence and safer land-use practices. For individuals, the chatbot provides fundamental disaster awareness, preparedness tips, relief information, and participatory reporting, thereby increasing awareness before and after the disasters. This study demonstrates how digital innovation can facilitate the operationalisation of Sustainable Development Goals, which directly address SDG 11 and 13—Sustainable Cities and Communities and Climate Action—and indirectly SDG 9 and 17—Industry, Innovation and Infrastructure and Partnerships for the Goals.



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sciforum-168566: ADAPTATION TO THE ABSENCE OF URBAN GREEN SPACES: A BEHAVIORAL RESEARCH ON THE RESIDENTS IN SAN PEDRO, LAGUNA

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Rapid urbanization in the Philippines has significantly reduced the accessibility and functional quality of public green spaces, particularly in densely populated cities such as San Pedro, Laguna. Although sustainable city initiatives promote green urban development, limited attention has been given to how residents behaviorally adapt when green infrastructure is inadequate, poorly maintained, or weakly integrated into everyday urban life. This study, titled “Adaptation to the Absence of Urban Green Spaces: A Behavioral Study of Residents in San Pedro City, Laguna,” examines how urban Filipinos respond to these spatial constraints through the lens of Environmental Possibilism. Using a qualitative-dominant mixed-methods approach, the research evaluates residents’ perceptions alongside documented on-site behavioral observations. Findings reveal a strong perception of inadequacy and limited functionality among existing parks and plazas. In response, residents adapt by utilizing alternative outdoor spaces for leisure, recreation, and social interaction. Frequently used areas include sidewalks, vacant lots, basketball courts, mall open areas, and private home gardens. Although informal and not originally intended as primary green environments, these spaces effectively function as substitutes for formal public parks. The study emphasizes the need for people-centered, behavior-informed urban planning that prioritizes accessibility, integration, safety, and everyday usability to create inclusive and meaningful green environments in dense Philippine cities.



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sciforum-175850: Adaptive Public Open Space Planning in A Cold-climate Ger District: A GIS and Participatory Study of Bilgekh Valley, Ulaanbaatar, Mongolia

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In Ulaanbaatar, the rapid and unplanned expansion of *ger* districts has significantly heightened exposure to seasonal environmental hazards. This vulnerability is further compounded by a critical deficiency in climate-resilient public open spaces. This paper presents a mixed-methods research framework and a reproducible approach for the adaptive planning of public spaces in Bilgekh Valley, a peri-urban *ger* district located in northern Ulaanbaatar. Covering approximately 7,460.17 hectares with a current population of roughly 28,950, the valley serves as a representative case of large-scale, unplanned informal settlement within a harsh, cold-climate urban fringe.

The study integrates GIS analysis with participatory mapping. The spatial-physical analysis is conducted using QGIS, leveraging high-resolution Digital Elevation Models (DEM) and Meteorological climatic datasets. By synthesising these data, the research generates surface runoff and flood indicators (including flow accumulation and slope) as well as wind and air stagnation indices to perform a comprehensive vulnerability assessment. The initial phase focuses on land-use balance and environmental evaluation to identify unplanned, underutilised, or misused vacant lots and parcels that currently obstruct the development of community spaces.

Concurrently, community mapping surveys were conducted to document environmental vulnerabilities—such as seasonal flooding, *aufeis* (groundwater icing), and localised pollution—while identifying potential intervention sites suggested by residents. This community-sourced data is digitised and integrated into the QGIS environment. This conference presentation outlines the methodological framework, preliminary land-use findings, and digitised participatory maps, discussing how these results inform potential interventions for adaptive open spaces. Ultimately, the research seeks to establish a reproducibility approach for planning climate-resilient public spaces in Mongolian *ger* districts and similar cold-climate informal settlements.



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sciforum-168187: AI-Based Multi-Criteria Risk Assessment for Civil Infrastructure under Extreme Environmental Hazards

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This study proposes an **AI-based multi-criteria risk assessment framework** to address the inherent subjectivity and limitations of traditional infrastructure evaluation methods in the face of extreme environmental hazards. The proposed methodology integrates **Artificial Intelligence (AI)**, **Fuzzy Logic**, and the **Analytic Hierarchy Process (AHP)** into a unified quantitative decision-support tool. Five major risk dimensions are systematically incorporated: **structural performance**, **environmental exposure**, **functional importance**, **emergency response capacity**, and **maintenance condition**. Quantitative indicators are processed using min-max normalization, while qualitative variables are transformed via fuzzy membership functions.

A key innovation of this research is the introduction of **AI-assisted weight calibration**, which utilizes historical failure data and gradient-based optimization to refine AHP weights. This mechanism effectively reduces subjective bias and improves weight stability by **18–25%** compared to conventional expert-only weighting methods. To validate the framework, a representative case study of a reinforced concrete bridge was conducted. The results yielded a **Comprehensive Risk Index (CRI) of 0.71**, indicating a **moderate-to-high risk level**. Structural performance and environmental exposure were identified as the dominant risk contributors, highlighting the coupled impact of aging assets and intensifying climate-related stressors.

Sensitivity analysis further demonstrated the framework's robustness against weight fluctuations, confirming its reliability for practical engineering applications. By providing a transparent and quantitative index, this research supports the implementation of **SDG 9** (Industry, Innovation, and Infrastructure) and **SDG 13** (Climate Action). The framework offers a practical foundation for infrastructure maintenance prioritization, disaster risk reduction, and long-term resilience enhancement in the face of global climate uncertainty.



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sciforum-172562: AI-Based Segmentation of Heritage Urban Morphology for Urban Heat Vulnerability (UHV) Assessment in Mediterranean Historic Districts

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Mediterranean historic districts are commonly perceived as climatically responsive due to compact urban form, shaded street canyons, and courtyard typologies. Yet their actual performance under intensifying heat extremes remains insufficiently evaluated within multidimensional Urban Heat Vulnerability (UHV) frameworks. This study develops an artificial intelligence-assisted spatial modelling approach to examine how heritage urban fabric influences heat vulnerability across two climatically comparable but morphologically distinct contexts: Amman and Seville.

High-resolution spatial data are integrated with three-dimensional urban form metrics derived from digital surface models, alongside thermal indicators and socio-demographic proxies structured under the exposure-sensitivity-adaptive capacity paradigm. Fine-scale segmentation of urban fabric enables the delineation of coherent morphological units, facilitating micro-scale analysis of enclosure ratios, canyon geometry, vegetation distribution, and topographic modulation. These spatial descriptors are subsequently incorporated into predictive vulnerability modelling to quantify the extent to which urban morphology mediates heat exposure and adaptive capacity.

Comparative findings indicate that while compact heritage configurations may attenuate direct solar gain in certain geometries, limited vegetation coverage, material thermal inertia, and socio-economic constraints can amplify the risk of residual heat. Marked differences between the morphology of Amman and the courtyard-dominated fabric of Seville underscore the critical role of three-dimensional structure in shaping intra-urban thermal inequities. By integrating urban fabric analysis within a vulnerability-oriented framework, the study advances a transferable methodology for evaluating climate resilience in historic districts. It supports heritage-sensitive adaptation strategies in rapidly warming Mediterranean cities.



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sciforum-164207: Applying Spanish Experiences in Climate Adaptation to the Brazilian Context

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Climate change has intensified urban impacts worldwide, disproportionately affecting cities in developing countries where social vulnerability, institutional fragility, and financial constraints are more pronounced. This study examines Spain's experience with climate change adaptation at the local level and discusses how its strategies can be realistically adapted to the Brazilian context, taking into account governance challenges and limited financial capacity. The research combines a review of national, regional, and local climate adaptation policies in Spain and Brazil with technical visits to Spanish cities (including Barcelona, Madrid, Seville, Málaga, Córdoba, Granada, and Zaragoza). Spain stands out for its structured, multilevel climate governance, supported by a national adaptation plan, strong regional climate legislation, and well-defined municipal strategies. In contrast, Brazil faces fragmented governance, weak coordination across government levels, uneven municipal capacity, and persistent difficulties in mobilizing financial resources. Despite these differences, several Spanish adaptation strategies show high potential for application in Brazilian cities, particularly because of their relatively low cost and scalability. These include the following: 1) climate shelters, to protect vulnerable populations during heatwaves and extreme weather; 2) urban drainage systems and infiltration gardens, to reduce flood risks; and 3) shading structures and public water points, to mitigate the urban heat island effect and episodes of low relative humidity. When adapted to local realities, such measures can be integrated into existing urban infrastructure, implemented gradually, and subsidized by federal budgets—with the possibility of leveraging foreign and private sector financing. The Spanish experience demonstrates that effective climate adaptation does not depend solely on high levels of investment, but on coordinated governance, citizen participation, and context-sensitive planning. For Brazil, adapting these strategies represents a concrete opportunity to advance urban resilience, provided they are aligned with local vulnerabilities, supported by political commitment, and complemented by accessible financing and international cooperation.



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sciforum-175852: Building a Resilient Community for a Person with Disability through Integration of Accessibility Issues with DRR in Dhaka City

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Disabled people are often neglected by the state, policymakers, community and even family, though they should be provided equal opportunities to develop their lives. A PwD (Person with Disabilities) has the right to access any facility in society. Regrettably, they are overlooked in our community, especially in terms of accessibility to infrastructure such as pedestrian pathways, vehicular circulation, public buildings, and other amenities. As a disaster-prone country, Bangladesh frequently experiences natural and anthropogenic disasters. In the event of a disaster, they should be provided with essential facilities to overcome the situation; however, they are not even included in Bangladesh's DRR (Disaster Risk Reduction) policy. In major urban areas like Dhaka, disasters such as fires, earthquakes, waterlogging, and building collapses pose a significant threat to city residents. These events affect PwD much more adversely than non-disabled people, and they pose a significant barrier to the rescue, evacuation, and resettlement of PwD. Precedent research indicates that a disabled person has less priority in DRR because there is no integration between disability and disaster management issues, and there is no proper execution or monitoring of the existing legislation either. The methodology of this research will include these three steps: a) analysis of the existing policy, rules, regulations, and guidelines regarding the accessibility of PwD in different infrastructures.; b) analysing the implementation of those policies and the present condition of PwD accessibility, especially in disaster events; and c) suggesting guidelines to include the issues of PwD in developing an efficient and inclusive disaster management policy in urban areas. By analysing existing policies and good practices that consider disability in DRR, this research will provide firsthand evidence of the crucial role of PwD inclusion in holistic DRR interventions.



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sciforum-172721: Comparative Evaluation of LiDAR and UAV Photogrammetry for Urban Inventory Mapping through an Automated Scan-to-BIM Framework

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Global urbanization has grown rapidly over the past century, increasingly expanding into areas prone to natural hazards. However, insufficient planning has led to informal expansion and a lack of up-to-date cadastral data and base maps necessary for informed urban governance and effective disaster risk management. In response to this problem, automated Scan-to-BIM workflows have emerged as a strategy for the 3D reconstruction of buildings to support the updating of urban cadastres. Although unmanned aerial vehicle (UAV) technologies enable efficient data acquisition using photogrammetric techniques and LiDAR sensors, a gap remains in the comparative evaluation of their performance in detecting building footprints within automated Scan-to-BIM frameworks for urban applications. In this context, the present study develops a comparative evaluation of both approaches.

Two flight campaigns were conducted over the same study area: (1) a DJI Matrice 4E for photogrammetric data acquisition and (2) a DJI Matrice 400 equipped with a Zenmuse L2 LiDAR sensor. Georeferenced point clouds were generated from both flights and processed using an automated Scan-to-BIM workflow to produce georeferenced BIM models at Level of Development (LOD) 100, representing building volumes. Performance was quantitatively evaluated based on geometric accuracy, level of detail, and model integrity.

The results highlight the differences between the two technologies: LiDAR demonstrated greater consistency in capturing complex geometries and fewer gaps in dense urban areas, achieving better volumetric definition, while UAV photogrammetry offered competitive planimetric accuracy and advantages in terms of cost and acquisition time. Overall, this confirms the feasibility of integrating UAV technologies into Scan-to-BIM workflows for the generation of 3D urban cadastres, contributing to urban planning and risk management.



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sciforum-168662: Comparative Study of Flood Resilience Strategies: Lessons from Hat Yai, Thailand, and Tokyo, Japan, under Climate Change Scenarios

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In November 2025, catastrophic flooding in Hat Yai, Thailand, was indisputable evidence of a failure in risk management. Stormy rain combined with inadequate planning caused the disaster. In three days, 595 mm of rain fell, overwhelming drainage systems and retention infrastructure. The flooding impacted transportation routes, homes, and businesses. Past the immediate damage, the disaster highlighted gaps in flood risk management. These include climate change adaptation, early warning systems, inter-agency cooperation, and community preparedness.

In contrast, Tokyo demonstrates a comprehensive flood-resilience system. It integrates scalable infrastructure, advanced forecasting, early warning systems, and community preparedness. An accurate flood risk assessment addresses the urban vulnerabilities caused by heavy rainfall. Early warning and robust evacuation plans help quickly share risk information. Community training is most important. This highlights that social preparedness is as critical as physical, organizational, and institutional abilities.

This research synthesizes the 2025 Hat Yai flood event and Tokyo's flood resilience system. It highlights key challenges and transferable lessons for climate-vulnerable cities. Using both cases, this study gives policy recommendations. They focus on data-driven early warning, flexible water retention, smart evacuation planning, and ongoing public education. To improve flood risk management, the strategies stress balanced urban planning, systematic climate adaptation, and resilient long-term approaches.



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sciforum-175833: Construction of community resilience dynamic monitoring and real-time evaluation model framework based on multi-source data fusion

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Abstract: **【Purpose】** In light of the frequent occurrence of disasters nowadays, the construction of urban resilience has once again attracted significant attention. As the fundamental living unit of a city, the community is of particular importance in enhancing resilience. Existing studies primarily rely on static assessment results as the basis for implementation and retrofitting, which fails to provide the optimal timing for risk early warnings and precise governance interventions within communities. **【Method】** This research employs comparative analysis and inductive-deductive reasoning. From the perspective of resilience assessment and utilizing multi-source data as the methodology, it develops a framework for a dynamic monitoring and real-time assessment model of community resilience based on multi-source big data. **【Result】** The model can effectively identify the dynamic changes in community resilience during both normal operations and emergency events. It is capable of pinpointing issues such as inadequate infrastructure capacity and problems arising from the concentration of high-risk populations, thereby validating the model's sensitivity and practicality across spatial and temporal dimensions. **【Conclusion】** This framework can serve as an important tool for community renewal, providing a management instrument for enhancing the normalization and intelligence of community resilience. To enhance the quality of life for residents in the future and promote effective planning, efficient management and practical services in the community.



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sciforum-175981: Cultivating Climate Resilience: Communal Gardens as Socio-Ecological Infrastructure

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Currently, urban areas are becoming more susceptible to climate-related risks such as urban heat island effects, biodiversity loss, food insecurity, and increased social fragmentation. Although Nature-Based Solutions (NbSs) have been recognized as a key approach to addressing these issues, their socio-ecological characteristics have been less explored. This paper seeks to reconceptualize communal gardens as socio-ecological infrastructure that encompasses collective governance as well as environmental adaptation in European capital cities. To carry out this study, a multi-scalar approach is utilized. First, this paper examines climate action plans of selected European capital cities to determine how communal gardens feature in urban adaptation strategies. Second, spatial analysis of communal gardens is carried out to assess their role in regulating urban microclimates and promoting biodiversity ecological connectivity. In addition, governance systems, participation mechanisms, and collective management of communal gardens are also evaluated to determine their role in collective governance. The study reveals that communal gardens are hybrid infrastructures that reduce microclimate effects, increase biodiversity, and improve soil permeability, as well as fostering social cohesion, food security, and participatory governance. Their adaptability is seen not only in their ecological performance but also in their capacity to integrate ecological functions with social cohesion and place-based identity. By considering communal gardens as socio-ecological systems, they contribute to developing a framework for integrating community-oriented, nature-based solutions into urban climate policy. They also provide transferable knowledge for other cities aiming to harmonize climate adaptation, social equity, urban common spaces, and resilience.



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sciforum-152485: Enhancing Urban Resilience through GPT-Driven Synthetic Geoscience Datasets: A Framework for Landslide Hazard Analysis

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Urban resilience in the face of climate-induced natural hazards critically depends on the availability of robust, high-quality datasets. However, geoscience research on landslides is hindered by limited access to consistent textual and image-based datasets. This study introduces a novel framework that leverages Generative Pre-Trained Transformer (GPT) models to synthetically generate and analyze geoscience data, addressing critical data scarcity challenges. Using prompt-engineering techniques, we autonomously generated 115 landslide events, each described by 14 parameters including event date, location (latitude/longitude), trigger cause, size, injuries, and fatalities. Statistical analysis revealed strong correlations between injury count and fatalities ($r = 0.986$), while seasonal analysis highlighted that large-scale landslides occur predominantly during the summer months, with higher event concentrations in India and Thailand. The synthetic dataset achieved significant diversity, encompassing 57 distinct latitudes, 56 longitudes, 42 trigger causes, and 16 categorical landslide types, thereby demonstrating its realism and potential scalability. Furthermore, visualization outputs—including heatmaps, bar charts, and AI-generated images—illustrated GPT's capacity to effectively communicate analytical outcomes. Implemented via Microsoft Power Automate and GPT-3.5 APIs, the framework demonstrates high reproducibility and scalability, with potential to generate hundreds of thousands of hazard records for urban risk modeling. By integrating GPT into the disaster intelligence pipeline, this research provides a replicable model for enhancing urban adaptation strategies, supporting predictive analytics, and informing proactive resilience planning. Ultimately, this study establishes GPT as a transformative tool in bridging data scarcity for geoscience, offering scalable pathways to strengthen the resilience of urban systems exposed to disaster risks.



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sciforum-172612: FairGNN-Climate: Fairness-Constrained Graph Neural Networks for Urban Neural Resilience Under Climate Stress

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Rapid urbanization and climate change are increasing environmental stressors such as heat waves, air pollution, and noise in densely populated cities. These stressors disproportionately affect vulnerable communities and are closely linked to neurological and mental health challenges, including anxiety, cognitive strain, sleep disruption, and reduced resilience. However, most climate and health prediction models focus mainly on improving accuracy and often overlook fairness, which can unintentionally reinforce existing social inequalities embedded within urban systems and public infrastructure.

This study presents FairGNN Climate, a graph based framework designed to predict urban neural resilience under climate stress while incorporating fairness considerations directly into the learning process. The system represents urban populations as interconnected graphs that combine environmental exposure, socioeconomic conditions, health indicators, and demographic information. By modeling relationships between neighborhoods and shared climate exposure, the framework captures patterns of correlated vulnerability that traditional independent sample models often miss. Fairness measures, including demographic parity and equalized odds, are integrated during training to reduce disparities across different population groups.

The framework is developed as a complete decision support platform that enables resilience prediction, fairness evaluation, geospatial vulnerability analysis, and counterfactual policy simulation. Applied to real urban data from Indian cities, the results demonstrate that the model produces interpretable resilience estimates and highlights structural disparities that require continued monitoring, responsible governance, and sustained policy level attention.



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sciforum-171936: From Consultation to Co-Production: Governance Models in Placemaking-Led Urban Design

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Placemaking, as a tool within the discipline of urban design, promotes participation that moves from consultation towards co-production. Although the idea of participation where citizens are seen as co-authors rather than merely respondents has long been discussed in urban planning and design, in practice it still largely remains within a consultative framework. This paper argues that when placemaking is embedded within institutional structures, it can function as a governance model rather than simply as a project-based intervention. By examining governance transitions within urban contexts, the study explores how co-production can achieve meaningful urban design outcomes and strengthen inclusivity in public space development.

The study adopts a qualitative multi-case methodology combining document analysis, policy review, and comparative case synthesis of participatory models, tactical urbanism initiatives, and community-led stewardship mechanisms. The governance structures are analysed through the degree of citizen agency, institutional integration and continuity of engagement. A governance transition matrix is developed to distinguish between consultative, collaborative, and co-productive models within placemaking processes and organisational structures. The findings suggest that projects where participatory mechanisms are institutionally embedded demonstrate greater spatial adaptability, stronger long-term community ownership, and enhanced social inclusion. The research concludes that placemaking becomes a transformative urban design tool only when governance structures move beyond occasional consultation towards structured co-production. The paper positions placemaking as an institutional strategy capable of recalibrating power, responsibility, and spatial authorship.



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sciforum-172759: Impact of Urban Spatial Configuration on Massive Pedestrian Tsunami Evacuation through Agent-Based Modeling

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Tsunami evacuation planning has relied on static maps generated by Least Cost Distance models, which calculate optimal routes based on street network lengths. However, by focusing on average evacuation times, these methods present limitations by ignoring the complexity of human behavior and failing to identify which variables are crucial to understand evacuation times. This suggests that current evacuation maps require improvement through the integration of simulation analysis to address underestimate risks in uncertain scenarios. This research performs a massive simulation analysis by integrating the Social Force Model with high-performance multi-threaded computing to generate comprehensive scenarios with different evacuation times.

The analysis is applied to the vulnerable coastal zone of Las Brisas de Villa in Chorrillos, Lima. Stochastic scenarios were executed by varying the initial population placement. The study focuses on analyzing the resulting distribution of high evacuation times to reveal scenarios representing low probability but high-impact events. By isolating the simulation seeds of these critical outliers, the specific spatial arrangements were reconstructed and examined.

Preliminary findings indicate that risks are driven by specific urban spatial configurations. These results demonstrate that evacuation times are dependent on the urban spatial configuration. Consequently, the identification of statistical outliers in evacuation time distributions is crucial for mitigating hidden spatial configurations that average-based models fail to detect.



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sciforum-172155: Institutional Decision-Gates in Pluvial Urban Flood Resilience: Fiscal Constraints and Fragmented Authority in Gowa Regency, Indonesia

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Urban pluvial flooding occurs persistently in many secondary cities in the Global South. While previous urban resilience research has generally highlighted hydrological modelling and infrastructure performance, institutional decision-making processes remain underexplored, particularly in identifying when and how governments intervene. This study employs an Institutional Decision-Gate perspective to explore how fragmented authority, strategic priority programs, and budgeting structures affect adaptive flood governance in Gowa Regency, Indonesia.

This study employs a qualitative case study approach grounded in semi-structured interviews with key stakeholders from the Public Works Department, Regional Disaster Management Department, Regional Development Planning Department, Environmental Department, and sub-district officials. The Annual Government Work Plan, Medium-Term Regional Development Plan, Work and Budget Plan, and Participatory Development Planning Forum Reports were reviewed for triangulation. The data were analyzed using thematic coding and process tracing to identify iterative decision thresholds and filtering mechanisms.

The analysis shows a three-phase Institutional Decision-Gate model of flood mitigation governance. The first gate represents a legitimacy threshold; responses are elicited not only by the hydraulic severity of an event but also by public visibility, disruption to strategic sectors, and leadership attention. The second gate reveals constraints imposed by sectoral budgeting and annual fiscal allocations. Despite the existence of technical knowledge and experience within departments, interventions are shaped around fixed maintenance and capital budgets that limit flexibility. Finally, strategic prioritization shapes decision-making, as drainage programs must compete with other sectoral priorities and be consistent with development visions.

By integrating urban flood resilience within institutional decision-making processes, this research shows that adaptive capacity in secondary cities is influenced less by infrastructure issues than by sectoral budgeting mechanisms and fragmented fiscal authority. The Decision-Gate framework shows how legitimacy, capacity constraints, and strategic prioritization function collectively to structure adaptive governance outcomes.



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sciforum-160055: Integration of Sustainable Urban Drainage Systems (SUDSs) in highway projects in Small Island Developing States (SIDSs) for improved resilience to flooding

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Road infrastructure is essential for societal development, but is increasingly affected by flooding due to climate change. Sustainable Urban Drainage Systems (SUDSs) have recently emerged as an alternative to traditional drainage systems for better stormwater management and improved resilience. However, their uptake is still slow in Small Island Developing States (SIDSs). This research was conducted in Mauritius, which is a SIDS of volcanic origin, approximately 1,865 square kilometres in size and characterised by coastal plains and mountainous regions in the central part. The aim was to understand the potential for integrating various SUDS in major road projects and identify existing barriers and potential enablers. A qualitative approach was used through a semi-structured interview with 20 experts who have worked on highway infrastructure projects in Mauritius to gather information relevant to the research aim. Results showed that for Mauritius, the most feasible solutions were swales, soakaways, and infiltration trenches, due to their ease of implementation and lower costs. However, soil infiltration and water table levels pose significant challenges. However, other SUDS types, such as retention ponds, bioretention areas, and constructed wetlands, were not considered favourable due to their large land requirements. Permeable paving areas, although successfully used in parking areas and pedestrian walkways, were also rated poorly for integration into major road projects due to their lower traffic-load-bearing capabilities and riding quality, and to higher noise generation. Potential enablers identified included financial incentives, governmental regulations, and the implementation of pilot projects as showcases for SUDS efficacy in managing stormwater. The study has contributed to identifying the most suitable SUDS components for implementation in road projects in Mauritius. It can help provide a strong reference for other similar SIDS in establishing economic and regulatory policies to foster their uptake by engineers, planners, and land developers.



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sciforum-175790: LAND USE TRANSFORMATION IN COASTAL SEAWEED FARMING VILLAGES: SPATIAL AND SOCIAL PERSPECTIVES

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This paper showcases adaptive community arrangements regarding land use transformation in coastal informal settlements. The specific focus was to ascertain the level of access of residents' land ownership and uses over decades against different external interventions. The paper also presents processes of adaptation and modification evolving as part of the interactions among stakeholders in dealing with basic infrastructure issues and related problems in the area caused by such land arrangements. Set against a backdrop of addressing gaps in formal planning systems which impose a 'one size fits all' approach in developing typology of land use change over time, this study outlines the importance of human-scale mapping and planning in informal settlements to understand local contexts and provide accurate baseline data and information to utilize in basic infrastructure planning and development in the Global South. In addition, the paper expands methods in spatial and social mapping as effective tools to analyze land use change and interconnected variables influencing development in response to lack of details acquired by conventional mapping tools. Utilising a case study of coastal seaweed farming settlements, the methods applied include the use of human-scale mapping documenting 3D typology of the settlements as well as social-economic and cultural attributes in order to develop a comprehensive information regarding land use transformation.



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sciforum-171590: Landscape-Oriented Strategies for Integrated Urban Regeneration in Complex Cities

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Contemporary urban contexts are increasingly characterized by spatial fragmentation, environmental stress, and social vulnerability, requiring planning approaches capable of addressing complexity beyond traditional sector-based frameworks. In this perspective, landscape-oriented strategies provide an effective interpretative and operational lens for understanding cities as integrated socio-ecological systems, where environmental processes, spatial structures, and human practices dynamically interact. This contribution explores the role of landscape as a structuring framework for urban regeneration strategies in complex and fragile urban environments. Landscape is interpreted not merely as a physical or perceptual dimension, but as a multi-layered system integrating ecological networks, public spaces, cultural identity, and everyday urban practices. Such an approach enables the identification of spatial relationships, criticalities, and opportunities that can inform adaptive and inclusive regeneration pathways. The study adopts a qualitative and analytical methodology based on spatial interpretation, urban policy analysis, and the examination of contexts characterized by marginalization, infrastructural discontinuities, and environmental vulnerability. Particular attention is given to the capacity of landscape-oriented approaches to support integrated decision-making processes, enhance urban resilience, and promote socially inclusive transformations over time. The findings highlight how landscape-based strategies can contribute to more coherent and context-sensitive urban regeneration processes, fostering stronger connections between environmental quality, social inclusion, and spatial governance. The paper contributes to ongoing debates in urban science by reinforcing the role of landscape as a key driver of sustainable urban transformation.



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sciforum-172784: Microclimatic Variability and Thermal Discomfort during a Terral Event: The Role of Vegetation and Urban Form in Málaga, Spain

Pablo Cozano-Pérez, Jaime Francisco Pereña-Ortiz, Begoña Galindo-Ruiz, Pedro Miguel Guerrero-Serrano, Álvaro Marin-Calle, Alba Gil-Martín, Ángel Ruiz-Valero

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Extreme heat events pose significant challenges for Mediterranean cities. This study evaluates the influence of vegetation and urban morphology on thermal comfort during an extreme heat episode in Málaga (Spain). Air temperature, relative humidity, land-surface temperature (LST), and the Temperature–Humidity Index (THI) were assessed across 13 green and grey infrastructures.

Microclimatic measurements were conducted in situ during a terral event in August 2024, a local hot-and-dry wind phenomenon. Air temperature and relative humidity were recorded every two hours using a thermo-hygrometer, while surface temperature was assessed every four hours using infrared thermography. A Bayesian linear modeling framework was applied to estimate posterior means and credibility intervals to evaluate spatial and temporal variability.

The results revealed marked thermal heterogeneity. Sites with continuous tree canopy or shading structures exhibited lower air and surface temperatures and more favorable THI values than exposed impervious surfaces. In contrast, children's playgrounds, bus shelters, and sports facilities reached critical surface temperatures and experienced elevated thermal discomfort for prolonged periods. Narrow streets exhibited relatively favorable thermal conditions due to self-shading, even in the absence of tree cover, indicating a complementary effect of urban morphology.

These findings underscore the importance of integrating vegetation and urban form into climate-adaptive planning strategies. The study provides empirical evidence supporting the prioritization of thermally vulnerable urban typologies. It reinforces the role of green infrastructure and passive design strategies in enhancing the thermal resilience of Mediterranean cities.



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sciforum-164914: Modeling U.S. Municipal Waste Management Based on Per Capita Generation and Disposal Trends

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Over the past six decades, rapid population growth and shifting consumption patterns in the United States have significantly reshaped municipal solid waste (MSW) management, with population nearly doubling and MSW generation more than tripling between 1960 and 2018, driving higher per capita waste outputs and intensifying environmental pressures as economic development and urbanization expand both household and commercial waste streams. This study responds to the need to understand how long-term demographic and behavioral trends affect landfill reliance, recycling capacity, and sustainability outcomes by quantitatively examining nearly sixty years of national MSW data to evaluate relationships between population growth, total MSW volumes, per capita generation, recycling and landfill shares, and energy recovery through combustion. Using these historical data, this study develops linear regression models to forecast major waste streams through the year 2200, while imposing explicit constraints primarily capping the recycling and composting rate at 70% and fixing the combustion rate at 12.9% of total MSW generation, to keep long-term projections within plausible technological and policy limits. The analysis suggests that resource recovery efforts continue to improve, with recycling and composting eventually reaching the 70 percent cap by the late 21st century, indicating substantial gains in diversion efficiency and processing capacity; however, the sustained linear growth in total MSW generation, driven largely by population expansion and rising per capita consumption, ultimately overwhelms these efficiency gains. The major finding is that even under optimistic recovery assumptions, the absolute tonnage of waste requiring landfill disposal is projected to rise sharply in the 22nd century, underscoring that improved management efficiency alone is insufficient and highlighting the critical importance of strategies that directly reduce waste generation through source reduction, material reuse, and systemic shifts in production and consumption



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sciforum-166779: Municipal Vulnerabilities to Climate Change in Goiás: an integrated analysis based on secondary data

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Climate change has intensified the occurrence of extreme events in Brazil, increasing social, economic, and environmental risks, especially in municipalities that lack policy instruments and actions to adapt to climate change. In this context, attention is drawn to the increased frequency of droughts, heavy rains, heat waves, and their direct impacts on urban populations and productive activities, in association with the scarcity of integrated diagnoses at the municipal level that support public adaptation policies. The objective of the study was to comparatively assess the climate vulnerabilities of the municipalities of Goiânia, Jataí, and Itumbiara, considering their distinct territorial and economic functions. To this end, a methodology based on a literature review and analysis of secondary data from official agencies and national platforms, such as IBGE, INMET, SEEG, ONS, AdaptaClima, and AdaptaBrasil MCTI, was adopted. In addition, a survey of news reports was conducted to identify records of extreme events, material damage, and human losses. The data were organized and analyzed using geoprocessing tools and spreadsheets, allowing for an integrated and comparative approach. The results indicate that Goiânia has high climate sensitivity, associated with high water demand, intensification of heat islands, and recurrent urban flooding. Jataí shows vulnerabilities related to dependence on agricultural production, with risks to food security in the face of prolonged droughts. Itumbiara, although relatively less sensitive, is vulnerable to reduced hydroelectric reservoir levels and water seasonality. It is concluded that municipal climate vulnerability is strongly conditioned by the economic matrix, the water supply system, and planning capacity. This study reinforces the importance of using integrated secondary data to support the formulation of local strategies for adaptation to climate change.



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sciforum-175596: Nature-based Solutions as a Tool for Mitigating "Slow Disasters" in Marginalized Urban Heritage

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Introduction: This research addresses the challenge of "slow disasters"—the chronic, incremental degradation of urban ecosystems and social fabrics—within marginalized residential areas. While Nature-based Solutions (NbS) are often applied to new developments, their role in rehabilitating early 20th-century urban heritage remains under-explored. This study examines how NbS can be integrated with cultural memory to foster resilience in the specific contexts of Budapest and Bucharest.

Methods: The study employs a multi-disciplinary approach combining circular economy principles with digital humanities. I utilize StoryMaps as a phenomenological mapping tool to overlay technical environmental data with narrative storytelling. This "Architecture of Convalescence" methodology treats the city as a recovering organism, using heritage documentation to identify sites where green interventions can repair both ecological and psychological "mental maps."

Results: The findings indicate that rehabilitating existing residential heritage through NbS (such as green courtyards and permeable surfaces) is more carbon-efficient than reconstruction. In the Budapest-Bucharest axis, marginalized spaces often coincide with high-density 20th-century housing. My mapping reveals that integrating "slow tourism" and cultural routes into these areas transforms them from isolated hazard zones into resilient, productive landscapes that mitigate urban heat and improve inhabitant well-being.

Conclusions: The research concludes that NbS are most effective when grounded in the "spirit of the place." By linking ecological restoration with cultural sustainability, cities can move beyond temporary fixes to long-term systemic resilience. This holistic framework provides a scalable model for Central and Eastern European cities to address the dual pressures of climate change and heritage decay.



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sciforum-175508: Operationalizing Creative Diversity as a Multi-scale Diagnostic Framework for Urban Resilience

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Urban resilience requires the integration of ecological, social, and functional capacities. However, existing approaches in urban design favor specialized methodologies that are, at the same time, often characterized by a sectoral and siloed approach, lacking diagnostic tools that capture cross-dimensional interdependencies across spatial scales. This study develops a Creative Diversity framework that unifies these dimensions into a coherent analytical structure for diagnosing resilience deficits in adaptive urban transformation processes. Creative Diversity is articulated through three conceptual dimensions: Space for Nature, addressing ecological connectivity and environmental performance; Space for Community, addressing social inclusivity and cultural identity; and Space for Function, addressing functional flexibility and economic viability. The framework intersects these dimensions with two fundamental resilience capacities: adaptive capacity to absorb disturbances and transformative capacity to reorganize toward new pathways. This intersection forms a diagnostic matrix that systematically identifies resilience deficits across scales. The framework was validated through a case study of Villa Guzzi and its surrounding neighborhood in Lecco, Italy, using multi-scale spatial evidence including geospatial analysis, municipal planning data, and on-site survey. The assessment revealed that resilience deficits across the six dimensions are structurally interconnected, with weaknesses in one dimension reinforcing deficits in others. Cultural identity was the only dimension to reach the acceptable baseline, yet this isolated strength did not generate systemic resilience. This pattern was consistent across both neighborhood and site scales, confirming that multi-scale and cross-dimensional diagnosis is essential for understanding the compounding nature of urban vulnerability. These findings demonstrate that effective urban resilience assessment requires diagnostic tools capable of integrating ecological, social, and functional dimensions within a unified structure. The Creative Diversity framework provides such a methodology, contributing to integrated approaches for adaptive urban transformation.



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sciforum-173591: Parks that are lived in and parks that are avoided: Habitability and quality of public space in Bellavista, Callao

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Public space plays a fundamental role in the construction of livable cities, as it promotes social interaction, permanence, and the development of everyday life. However, not all parks activate these dynamics with the same intensity, as they present different levels of use and appropriation. In this context, the research aimed to identify which of the parks in the Jardines de Virú sector, located in the district of Bellavista, Callao, presents higher levels of habitability and urban quality. Likewise, the characteristics that influence these conditions were analyzed.

This research applied Jean Gehl's methodology in *The Human Dimension of Public Space* (2017). First, visits were conducted to the parks to record user attendance and the activities carried out. Based on this, behavioral mappings were developed to identify patterns of permanence, movement paths, and areas of greater or lesser occupancy. Then, the physical conditions of each park were evaluated, considering accessibility, visibility, furniture, and vegetation. Finally, surveys and interviews were conducted with users, which made it possible to identify who inhabits these spaces, the reasons for their use, and their level of satisfaction.

The results indicated that Virgen de Fátima Park presents better habitability conditions in Jardines de Virú. It stands out for its large green areas and spaces with natural shade. In addition, it has facilities that the other parks do not have, such as a senior center, a playground area, and a security booth. These characteristics, together with adequate accessibility, favor greater permanence and user diversity, consolidating this park as the highest-quality public space in the sector.



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sciforum-162067: Socio-Political Infrastructure as a Resilience Catalyst: Validating the Kerala Model for Neutralizing Epidemiological and Ecological Shocks in Kochi

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Traditional urban planning over-prioritizes "hard" engineering, yet recent crises prove that physical assets alone cannot secure a city. This study investigates the "Kerala Model" -a paradigm prioritizing human capital and decentralized governance—as a premier framework for resilience. By contrasting the high-resource responses of Global Alpha++ megacities (London/NYC) as aspirational but flawed benchmarks against the community-centric model of Kochi, this research argues that socio-political infrastructure is a more agile catalyst for urban security than intricate physical systems.

The study utilizes a multi-scalar spatiotemporal analysis across seven domains. While the primary focus is on the COVID-19 pandemic, the research is significantly supported by a longitudinal analysis of the 2018 Nipah outbreak and subsequent major floods. The methodology integrates GIS-based land-use mapping and correlation analysis of mortality rates vs. population density. These tools are used to track how historical data from multiple crises informed the spatial and administrative management of the 2020–2022 health emergency.

Findings reveal that Kochi's success was rooted in a three-tier governance framework that converted disaster-response experience into a permanent "soft" system. Unlike the rigid, tech-driven systems of London/NYC, Kochi's built environment facilitated resilience through the strategic repurposing of social infrastructure—specifically local schools and neighborhood halls—into decentralized wellness hubs. This proactive surveillance was made possible by the proximity of localized healthcare facilities and a high level of social trust, which empowered a volunteer-led workforce to implement "Reverse Quarantining" and distribute essential supplies more effectively than top-down mandates.

This research validates socio-political infrastructure as the most sustainable path to securing urban environments against a spectrum of epidemiological and ecological shocks. It advocates for a "Community-Based Co-Design" philosophy that formalizes decentralized health networks and civic hubs as permanent urban features. By centering the Kerala Model, Kochi provides a definitive blueprint for global cities to achieve resilience through the strategic empowerment of social capital.



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sciforum-159809: Spatially Enabled Environmental Impact Assessment Using AI and GIS

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In the context of rapid urban expansion and infrastructure development, Environmental Impact Assessment (EIA) remains one of the primary regulatory tools guiding large-scale projects. However, its implementation continues to face challenges in many developing countries related to incomplete baseline data, limited spatial analysis, poorly structured impact evaluation, and the lack of standardized reporting frameworks. Addressing these challenges is critical for advancing sustainable urban development and informed planning decisions, which are central concerns of contemporary urban science research. This paper, positioned introduces EIA maps, an artificial intelligence (AI)-powered, Geographic Information System (GIS)-based decision-support tool designed to enhance environmental risk identification, mitigation planning, and comparative evaluation in large infrastructure projects. The study adopts a design-driven approach that integrates a systematic literature review, spatial data collection, hierarchical impact structuring by receptor, and rule-based analytical logic to operationalize EIA theory into a functional assessment system. The tool combines process-phase-based spatial analysis with lifecycle-sensitive environmental evaluation to generate location-specific impact assessments. EIA Maps was applied to three Egyptian airports; Cairo International Airport, Sphinx International Airport, and Sharm El-Sheikh International Airport, representing aviation functions across diverse geographic and environmental contexts. The results demonstrate that geographic location and operational intensity significantly influence environmental risk profiles and mitigation priorities. The findings also highlight the improved transparency, consistency, and decision-making capacity enabled by standardized, spatially integrated assessment methods. By integrating AI and GIS into the EIA process, the study contributes to emerging digital approaches in urban planning and environmental management. The paper concludes that AI-enabled GIS applications, such as EIA Maps, offer a scalable and transferable solution for strengthening EIA practice and supporting more sustainable and resilient infrastructure planning in Egypt and other developing contexts.



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sciforum-172240: Street-Level Hotspot Mapping from Municipal Drainage Unclogging Work Orders: Evidence for Risk-Based Prioritization in Guarujá, Brazil (2021–2025)

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Introduction: Urban flooding and recurrent stormwater drainage failures are often associated with clogged storm drains and microdrainage constraints. Municipal urban operations departments routinely register unclogging work orders, creating an operational dataset that can be leveraged to detect recurrence patterns and support preventive decision-making. This study proposes a practical method to map recurrent “hotspots” using municipal unclogging work-order records in Guarujá, Brazil, covering January 2021 to December 2025.

Methods: Work orders were consolidated at the street-name (logradouro) and neighborhood levels. House-number information was intentionally excluded due to historical inconsistencies in address completion. To minimize noise from spelling variants and abbreviations, we applied text normalization and string-similarity grouping to merge equivalent street names. Hotspots were defined and ranked using recurrence metrics (work-order frequency per street) and temporal persistence indicators (reappearance across different months and years). Neighborhood-level summaries were produced to identify spatial concentration of recurrent streets.

Results: The approach generates a prioritized list of streets with the highest recurrence and persistence, distinguishing isolated episodes from chronic locations repeatedly demanding reactive maintenance. The resulting hotspot inventory can support preventive maintenance scheduling, coordinated field operations, and the identification of sites where structural interventions may be more effective than repeated reactive responses.

Conclusions: Municipal work-order records can function as an administrative “sensor network” to detect street-level drainage hotspots and inform evidence-based prioritization for urban resilience and climate adaptation. The method is low-cost, scalable, and transferable to other cities facing recurring flooding and drainage maintenance burdens.



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sciforum-166857: Structural Health Monitoring and Earthquake/Climate Proofing by means of AI Sensor Fusion, Digital Twins and Smart Oracles

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Introduction

The rising intensity of climate and weather-related extremes, coupled with seismic risks, threatens the resilience of the built environment. This paper presents an integrated framework for Structural Health Monitoring (SHM) and earthquake/climate proofing that unites AI-driven sensor fusion, Digital Twins (DTs), and Smart Oracles within the blockchain-enabled decentralized data and knowledge ecosystem developed by the Horizon Europe project BUILDCHAIN.

Methods

Heterogeneous structural, environmental, climatic, and meteorological data streams are merged into a unified analytical pipeline, where AI models process vibration, acceleration, temperature, humidity, and related signals to extract modal properties, detect anomalies, and update structural performance indicators. Trustworthy data flows are ensured through a Decentralized Oracle Network (DON) connected to InterPlanetary File System (IPFS)-based distributed storage. Climate and weather datasets—historical, real-time, and forecasted—are transformed into Knowledge Assets (KAs), integrated into the Decentralized Knowledge Graph (DKG), validated through a reputation-based oracle mechanism, and stored immutably on the IPFS. AI-based fusion algorithms reconcile sensor observations with physics-based (i.e., Finite Element) models, triggering automated updating routines that refine key structural parameters (i.e., masonry or timber elastic moduli), which critically influence predictive accuracy under seismic and climate-induced loads.

Results

Pilot applications involving real buildings demonstrate the framework's ability to reduce discrepancies between as-designed and as-built performance. In two tall cross-laminated timber (CLT) buildings, AI-driven fusion and DT-based updating refined elastic modulus scaling factors derived from modal measurements, improving vibration-serviceability predictions. Deployments in the Hospital Real of Granada and the Palazzo Poniatowski Guadagni validated the approach with open, scalable SHM architectures, enabling quasi-real-time operational modal analysis and dynamic DT generation.

Conclusions

Combining AI-driven sensor fusion, DTs and Smart Oracles with decentralized data governance enhances SHM reliability, improves predictive performance, and supports real-time assessment of structural condition and vulnerability under seismic and climate stressors.



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sciforum-170993: Towards a conceptual Urban Digital Twin (UDT) Framework for Urban Climate resilience: integrating Systems, People, and Policy

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Intensifying urban heat significantly exacerbates existing disparities in exposure and coping capacities, creating an urgent need for equity-focused adaptation strategies. Since traditional resilience planning is often fragmented, this paper suggests that an Urban Digital Twin (UDT) is essential for integrating these resilience planning components into a cohesive system. This conceptual paper proposes a reusable UDT framework specifically designed to enhance climate resilience by testing scenarios in three core areas: physical infrastructure, social dynamics, and institutional governance. To achieve this, the study proposes a minimum UDT architecture comprising the following structure: an environmental module, a social vulnerability module, and a decision-making module. This operational design allows for the testing of three distinct scenario categories: (1) physical interventions in the built environment, (2) social support mechanisms for at-risk populations, and (3) institutional strategies for policy implementation. Most existing standard approaches rely on temperature and environmental analysis, whereas this multidimensional methodology argues for the distributional equity of interventions. This paper suggests that integrating these three main components within a UDT environment is critical for decision-makers. It enables the identification of strategies that effectively protect the most vulnerable residents, rather than merely optimizing for city-wide temperature averages, ultimately fostering more just urban climate governance to ensure lasting social equity and systemic resilience.



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sciforum-174183: Towards Climate-Resilient Urban Neighbourhoods: Evaluating Green Infrastructure Strategies through Environmental Simulations

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Climate change is accelerating extreme phenomena, including rising urban temperatures, which are particularly pronounced in densely urbanised areas. Like many Mediterranean metropolises, Naples is subject to severe heat waves that negatively affect urban quality of life, thermal comfort, and public health. The Vasto district, located in the heart of Naples, is a historic, high-density residential area characterised by a high degree of soil impermeabilisation, which intensifies the Urban Heat Island effect.

The study focuses on three experimental scenarios for the Vasto district, modelled through microclimatic simulations using the ENVI-met software, which enables detailed analysis of thermal and environmental variables. The three scenarios examined are: the baseline condition, reflecting the current state of the neighbourhood in the absence of any greening interventions; a green roofs-only scenario, in which vegetated coverings are applied to building rooftops; and an integrated scenario, combining green roofs with the introduction of street trees, to maximise the effectiveness of urban greenery in terms of heat reduction, thermal comfort improvement, and air quality enhancement.

The research aims to quantify the benefits of different greening strategies in improving local microclimatic conditions, with a particular focus on the variables of Mean Radiant Temperature and Potential Air Temperature. The simulations reveal that although green roofs alone yield positive effects, their integration with street trees is the most effective solution for reducing local temperatures and improving liveability. The results obtained provide a basis for urban policies aimed at enhancing the climate resilience of the Vasto district, suggesting integrated approaches that combine green infrastructure in a complementary and synergistic manner.

This study offers practical guidance for implementing nature-based strategies, proposing replicable solutions for other Mediterranean urban areas increasingly exposed to escalating climatic challenges.



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sciforum-168919: Translating Natural Adaptive Mechanisms into Urban Design: A Biomimetic Approach to Urban Resilience

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Climate change constitutes one of the most critical challenges for contemporary cities, directly affecting urban functionality, sustainability, and quality of life. Under these conditions, enhancing urban resilience and adaptability becomes imperative, requiring urban design to adopt innovative, nature-inspired strategies. This study approaches biomimetic design as a comprehensive method for addressing the impacts of climate change on the built environment. The research investigates mechanisms and strategies observed in natural systems that exhibit resilient, adaptive behavior under changing climatic conditions. These mechanisms are analyzed and translated into principles of urban design and spatial organization, aiming to support the development of urban environments that perform efficiently in environmental and climatic terms. The findings indicate that the application of biomimetic strategies within the urban context can be particularly effective in responding to climate-induced pressures. As an indicative example, the study examines the urban heat island phenomenon, one of the most evident impacts of climate change in cities. Through the adoption of biomimetic design approaches, this phenomenon can be significantly mitigated or even eliminated by reconfiguring urban systems in alignment with natural adaptive processes. In conclusion, biomimetic design is proposed as a suitable and forward-looking strategy for strengthening urban resilience and adaptability. Rather than addressing isolated climatic phenomena, it offers an integrated framework that contributes to the overall environmental robustness of urban systems, supporting cities in their long-term response to climate change.



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sciforum-128207: Urban Resilience and Adaptation in Brăila: From Citadel to Socialist planning

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This paper examines the long-term effects of past planning decisions in the city of Brăila, Romania, by analyzing two major periods of urban transformation: the post-demolition phase of the Ottoman citadel in the early nineteenth century and the socialist urban planning of the communist regime, culminating with the development of the Hipodrom neighborhood. While Brăila's historical development was systematically examined, successive planning paradigms that have generated persistent morphological structures that continue to shape the city's contemporary spatial challenges were not. This study addresses this gap by demonstrating how path-dependent urban forms produced during key historical transformations continue to structure present-day patterns of mobility, land use, and resilience.

The research adopts a diachronic urban morphology approach that integrates historical cartography, archival records, satellite imagery, and field observations. Morphological analysis focuses on the evolution of street networks, parcel structures, land-use patterns, and building typologies across the two periods, while planning policies and regulatory frameworks are examined to connect spatial transformations with their broader political and ideological contexts.

The findings indicate that the demolition of the Ottoman citadel around 1828 initiated Brăila's transition from a fortified settlement to a modern port city integrated into European trade networks. The implementation of a radial-concentric street pattern continues to organize the historic core and influence contemporary mobility and heritage management. In contrast, the socialist period introduced large-scale residential expansion based on standardized mass housing and functional zoning, exemplified by the Hipodrom neighborhood, between the 1960s and 1980s. Although designed to address housing shortages, this model produced high-density residential clusters and monofunctional urban areas whose spatial rigidity and aging infrastructure present significant challenges for present-day urban regeneration.

Understanding these layered transformations highlights the importance of historically informed planning strategies capable of reconciling inherited urban morphology with contemporary demands for sustainable and integrated urban development.



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sciforum-175885: Urban Resilience and Adaptation through Nature-Based Infrastructure: The Role of Peri-Urban Wetlands in a Warming City

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Urban resilience and adaptation are critical for rapidly expanding peri-urban regions, which face intersecting pressures from land use transformation and climate variability. The proliferation of impervious surfaces, loss of ecological buffers, and mounting anthropogenic emissions collectively undermine adaptive capacity by intensifying heat stress in cities. Advancing resilience requires a shift from conventional grey infrastructure to ecosystem-based strategies that can dynamically respond to environmental stressors.

This research evaluates the contribution of peri-urban wetlands to urban resilience and climate adaptation with special reference to heat stress. Focusing on the rapidly urbanizing landscape of Barasat, West Bengal, India, the analysis investigates the long-term land-use and land-cover (LULC) transitions from 1995 to 2025 and their implications for microclimatic regulation and environmental stability. Multi-temporal satellite data were employed to quantify changes in wetland extent, vegetation cover, and built-up expansion. These LULC dynamics were then correlated with key environmental indicators, including land surface temperature (LST) and air quality parameters.

The analysis reveals a significant decline in wetland and vegetated areas, which corresponds directly with elevated thermal intensity and diminished environmental buffering capacity. This quantifiable degradation signals a marked erosion of the region's urban adaptive capacity. Wetlands function as natural regulators by dissipating heat, retaining stormwater, and improving atmospheric conditions—ecosystem services that are fundamental to mitigating climate extremes. Their degradation, therefore, constitutes not only an ecological loss but also a systemic decline in urban living conditions.

The study concludes by advocating for the strategic positioning of wetlands as adaptive, nature-based infrastructure within urban resilience and adaptation frameworks. Integrating wetland restoration, protection, and continuous environmental monitoring through participatory governance can forge robust climate adaptation pathways. By embedding these ecosystems into Blue-Green Infrastructure networks, rapidly urbanizing cities can transition toward more resilient, climate-responsive, and sustainable development models.



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sciforum-172878: Urban Resilience and Disaster Risk Reduction: How Serious Games Enhance Evacuation Procedures in Transport Networks

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Natural and man-made disasters at the urban level represent a major challenge to increasing resilience. According to the UN Agenda 2030, Disaster Risk Reduction (DRR) is a priority at the global level. Different actions can be planned and implemented before and after a disastrous event. The focus of this research is on actions to take before the event to increase preparedness. This paper focuses on exercises and training activities designed to reduce the gaps between actions performed before and after disastrous events. These actions include discussion-based and operation-based actions, classified by increasing levels of complexity and capability. Serious Games (SG) represent a discussion-based action with the greatest level of complexity and capability. The objective of this paper is to investigate the potential contribution of SG to increasing preparedness for implementing evacuation procedures and thereby enhancing urban resilience. This implies the knowledge of urban mobility in evacuation conditions. This class of SGs combines Transport Risk Analysis (TRA), Transport System Models (TSMs), and emerging Information and Communication Technology (e-ICT) to reproduce, in a virtual environment, a transport system under evacuation conditions. In this way, it is possible to experiment with evacuation planning procedures in a virtual environment. The principal results of a pilot experiment are presented. The SG framework and its pilot implementation show how the potential contribution to increasing awareness and reducing exposure at the urban level can be quantified. The paper is of interest to urban scientists and public and private decision-makers involved in disaster risk planning processes.



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sciforum-175953: Urban Sustainability and the Role of the National Defence System

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Introduction:

This paper examines the interdependence between urban sustainability and the national defence system in Romania within the framework of integrated strategic planning. The study is grounded in the premise that a sustainable city is inherently a secure city, capable of anticipating and managing complex crises. Urban management is conceptualised as a central pillar in coordinating resilience through the integration of security and defence policies into spatial planning instruments, in accordance with the objectives established by the United Nations Agenda 2030 for Sustainable Development.

Methodology:

The research employs a qualitative analysis of the synergy between institutions within Romania's national defence system and local public administration authorities. It examines the integration of defence components into the urban environment, with particular emphasis on the protection of critical infrastructure and the implementation of the 2021 resilience guidelines issued by the North Atlantic Treaty Organization.

Results:

The findings indicate that Romania's national defence system has evolved beyond a strictly military role, emerging as a key actor in safeguarding the vital functions of society. A central aspect identified is the need to align General Urban Plans with national defence strategies in order to ensure efficient evacuation routes, emergency shelter infrastructure, and the designation of protective buffer zones. The proposed approach contributes to reducing urban vulnerabilities and strengthening institutional response capacity in times of crisis.

Conclusions:

Although the integration of strategic objectives within urban areas may generate social discomfort or perceptions of militarisation, the research demonstrates that such risks can be mitigated through participatory governance and transparent institutional communication. In conclusion, the national defence system acts as a supporting actor in strengthening community trust and ensuring long-term urban sustainability in Romania.



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sciforum-175226: Urban tree responses to climate and pollution: implications for environmental monitoring and management

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Trees mitigate climate change and enhance urban livability, though their effectiveness depends on health and growth. While exposed to altered climates and pollution, urban tree responses remain insufficiently quantified. This dendroecological study assesses how climate and pollution shape tree performance across contrasting contexts in central Italy, investigating peri-urban, traffic-dominated, and airport-influenced sites in Florence and Pisa. Tree-ring width (TRW) was measured to quantify growth variability, while stable carbon ($\delta^{13}\text{C}$) and oxygen ($\delta^{18}\text{O}$) isotopes were analyzed to infer changes in intrinsic water-use efficiency, photosynthetic activity, and stomatal regulation. Nitrogen stable isotopes ($\delta^{15}\text{N}$) traced pollution inputs from vehicular emissions. Additionally, macronutrients, trace elements, and heavy metals were determined using Laser Ablation Inductively Coupled Plasma Mass Spectrometry (LA-ICP-MS) to characterize spatial patterns of elemental accumulation linked to local pollution. A previous study showed that in urban parks, high temperatures and low rainfall affected tree physiology more than pollution, even though overall growth was not directly impaired. Carbon and oxygen isotopes highlighted this sensitivity to heat and drought, while the pollution indicator remained similar across urban and periurban parks. By integrating growth, stable isotopes, and elemental analyses, the present study demonstrates the potential of urban trees as effective long-term bioindicators of climatic stress and pollution. We expect reduced growth rates and higher intrinsic water-use efficiency in urban trees, reflecting heat and drought stress, alongside enriched $\delta^{15}\text{N}$ and elevated heavy metal concentrations. Ultimately, this study aims to emphasize the need to select climate-adapted species to maximize urban ecosystem services. Because cities currently experience the hotter, drier conditions expected globally in the future, they act as living laboratories for studying plant responses to climate change.



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sciforum-172353: WeAR Smart: A Pilot Study on AI-Driven Game-As-Reality (GAR) for Citizen-Centered Smart City and Urban Resilience in Indonesia

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Introduction: Indonesia's ambitious goal of becoming a "100 Smart Cities" nation faces a major socio-technical barrier: a significant civic-digital literacy gap that renders a viable trillion-dollar investment in infrastructure an operational liability. Although Internet penetration is high, a lack of understanding of urban complexities among citizens prevents their ability to participate in circular economies and climate mitigation. This paper introduces WeAR Smart, part of a pioneering Game-As-Reality (GAR) platform that connects the physical city with digitally enabled citizens through the use of an immersive, interactive, and educational application for climate adaptation. It aims to educate and engage citizens in "green" actions.

Methods: Using the GAMERS protocol (geste, ambiance, mechanics, engine, reality, and sustainability), we conduct a quasi-experimental pilot study (pre-post design) using 32 participants to utilize multimodal AI detection and augmented reality (AR) in the urban and climate resilience actions. Outcomes were measured using pre-post Urban Climate Literacy (UCL) surveys in knowledge (100-point scale), attitude (5-point scale), and in-app behavioral logging (15-point scale).

Results: Our program demonstrated significant improvements across all UCL dimensions. Knowledge scores increased from a baseline mean of 41.61 to 84.52 ($p = 0.0001$). Attitudes toward climate-positive behaviors improved from 2.96 to 3.81 ($p = 0.0001$). Verified and self-reported behaviors increase significantly from 4.28 to 13.84 ($p = 0.0001$).

Conclusion: This pilot study demonstrates that the GAR paradigm, with its WeAR smart, is prospective to increase urban and climate literacy. While it used a limited sample, this pilot provides a justified statistical foundation for future large-scale studies. It paves the way to increase its scale and integrate AI-driven solutions into formal policy management to ensure that cities move beyond being simply smart to becoming resilient against climate-induced disruptions with its citizen-centered intelligence.



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sciforum-182573: hy logistics companies should invest in Last-Mile Delivery? A comparative economic analysis of micro-hub solutions

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The rapid growth of e-commerce has transformed urban freight systems, making last-mile delivery (LMD) a critical component of urban mobility with important implications for congestion, emissions, and operational efficiency. In response, several innovative solutions have been proposed, including urban consolidation centres, alternative delivery vehicles, etc. Among these, parcel lockers (PLs) have emerged as a promising option because they enable delivery consolidation, reduce failed delivery attempts, and improve service reliability.

Despite the growing literature on LMD innovations, limited attention has been devoted to the economic and investment dimensions of parcel locker deployment, especially across different territorial contexts. This gap is particularly relevant in the current policy framework, where European and national strategies increasingly promote transport decarbonisation and smart urban logistics. Understanding under which conditions parcel lockers represent a viable investment is therefore essential for evidence-based decision-making.

This study investigates PLs as an investment strategy in urban LMD systems, adopting a broader perspective that conceptualises them as decentralised micro-hubs or micro-warehouses for freight consolidation and temporary storage. Building on a structured literature review, the paper addresses two research questions: how freight micro-hubs affect the cost structure of urban LMD systems, and to what extent investments in parcel lockers improve delivery efficiency and reduce operational costs.

The analysis develops a cost-based evaluation framework using key parameters identified in the literature, including delivery costs, failed delivery rates, consolidation effects, and distance reduction. Focusing on Italy, the study compares metropolitan, medium-sized, and peripheral cities, and provides practical recommendations for logistics operators considering parcel locker investments.



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Session 6. Urbanization and Social Development

sciforum-172795: Smart-City Visibility Gap across Settlement Sizes: Youth Perceptions and Local Connectivity in Slovakia

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Introduction: In the European understanding of smart cities, digital transformation is not limited to isolated ICT solutions but is expected to support integrated and sustainable urban development across mobility, energy, and public services. However, in smaller settlements, smart-city interventions may remain less visible to young residents, which can weaken civic awareness, trust in local innovation, and place-based learning. This study examines whether settlement size and local connectivity shape youth perceptions that their hometown has no smart-city features.

Methods: We analysed survey responses from Slovak secondary-school students and linked them with municipal population data and self-rated local internet quality. Logistic regression was used to test whether settlement size and municipal connectivity predict the perceived absence of smart-city elements.

Results: Students from smaller municipalities were more likely to perceive their hometown as lacking smart-city features, while this perception was less common in larger urban settlements. Better-rated local internet quality was also associated with a lower likelihood of reporting an absence of smart-city elements. Overall, the findings suggest that the visibility of smart initiatives is shaped not only by territorial scale, but also by the everyday quality of local digital connectivity.

Conclusions: The study points to a smart-city visibility gap across settlement sizes in Slovakia. From a European perspective, smart development should combine digital infrastructure with citizen-oriented, visible, and practically experienced services. Smaller municipalities may therefore benefit from clearer communication of existing initiatives, more visible pilot actions, and school-linked participation activities that help reduce territorial inequalities in smart-city awareness.



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sciforum-170869: Beyond Technology: A Two-Layer Assessment of Smart City Readiness in Muscat, Oman

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Smart city development is often led by new technologies, but technology alone does not guarantee meaningful urban change. This study examines Muscat, Oman's readiness to become a smart city, using a two-layer framework to assess smart city transitions in planning-led urban contexts. Guided by a readiness-based approach and informed by the Theory of Change, the study examines public awareness, cultural alignment, familiarity with smart technologies, everyday urban conditions, and perceptions of governance and institutional preparedness. Data were collected through a survey of 400 residents in Muscat and analysed using descriptive methods. The findings show that readiness for smart city development in Muscat is uneven. Strong cultural support and a generally high quality of life provide a positive starting point, and residents clearly value integrating local identity into smart city initiatives. However, technological readiness remains moderate, especially for less visible infrastructure systems, and governance and institutional capacity emerge as the main challenges. While many residents are familiar with the idea of smart cities, far fewer are aware of local initiatives, pointing to a gap between planning ambitions and lived experience. The study suggests that Muscat's smart city transition should focus less on introducing new technologies and more on strengthening governance, coordination, and community engagement, in line with long-term sustainability and urban planning goals under Oman Vision 2040. Beyond the case of Muscat, the proposed readiness-based framework offers a transferable approach for cities seeking to align technological innovation with governance capacity, cultural context, and community engagement in smart city development.



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sciforum-172570: The Nexus of Land Use Change, Urban Densifications, and Land Markets in Infrastructure-induced Regions: A Case Study on Bairag Union, Bangladesh

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Rapid and unplanned infrastructure development has tremendous impacts on land use and land cover dynamics; in particular, large-scale infrastructure projects reshape the peri-urban and rural landscapes in rapidly urbanizing regions of Bangladesh. The construction of the Karnafuli Tunnel bisected Bairag, a peri-urban union of Bangladesh, into two segments, potentially triggering a drastic impact on the LULC modifications and economic shifts. This study intends to investigate the nexus between LULC change, land price dynamics, and urban densification in Bairag over time, showcasing the impact of the crucial changes. At two-year intervals, Landsat 7 SR (2008–2012), Landsat 8 (2014), and Sentinel-2 (2016–2024) data were extracted to prepare supervised LULC maps of Bairag, which were classified into seven categories over 200 training signatures per class using Google Earth Engine, and a Kappa value >0.85 was achieved, denoting strong classification accuracy. The finding reveals an increase of more than three times in built-up areas, while the vegetation and agricultural lands decreased by 50% and 18%, respectively, in 2024 compared to 2008. Moreover, change detection maps were generated through pixel-by-pixel comparison of consecutive LULC maps, which eventually produced transition matrices to quantify land cover conversions, indicating stable pre-tunnel land dynamics and accelerated urban expansion and abrupt changes in the later years. Later, built-up zones extracted from supervised LULC maps were investigated through a sector-based buffer ring method, showing 500 m concentric rings and directional sectors from a predefined center to determine urban expansion in Bairag over the years. The urban densification toward the east and southeast directions was predominant, depicting the increase in areas by 123 and 111 times, respectively, indicating radial urban growth. Even the land price dynamics and built-up expansion indicated significant positive correlations. This study will contribute to sustainable land use planning, infrastructure governance, and equitable development strategies in rapidly transforming cities like Chattogram.



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sciforum-165299: An Urban Morphometrics Approach to Investigate the Quality of Urban Life in Saudi Arabia

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Rapid urbanisation has been reshaping cities worldwide, and Saudi Arabian cities have experienced a particularly fast and uneven transformation. This study examined how emerging urban structures in Saudi Arabia relate to societal change and, critically, whether differences in urban form are associated with differences in residents' Quality of Urban Life (QoUL). The aim was to generate evidence that could support more effective planning and help avoid planning mistakes. A selected city was quantified using computational Urban Morphometrics (UMM) by analysing the built environment at the building scale to generate distinct Urban Types (UTs) within the city. These derived UTs were then linked to the QoUL survey, in collaboration with the Saudi QoL program, to assess whether certain morphologies tended to align with higher or lower levels of perceived urban quality. The results showed that UTs were not equivalent in lived experience. Different UTs were associated with different QoUL levels. The findings indicated that measurable variations in urban morphology corresponded to systematic differences in QoUL, suggesting that the overall shape and structure of the area- and street-to-block building configurations mattered for residents' satisfaction. Overall, the study concluded that a morphology-based classification of Saudi urban structures provides a practical, evidence-driven foundation for planning. By identifying urban types linked to QoUL levels, planners could target interventions more precisely, reduce preventable design errors, and develop policies that better support improved QoUL across Saudi Arabia and the world.



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sciforum-164816: Challenges of green infrastructure planning: experience from comparative international studies

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Introduction. Urban green infrastructure (UGI), coinciding with different city nature categories, is important for its ecosystem services. Provision services are widely investigated because they can be quantified, but services with a societal impact are less explored. While significant progress has been made in understanding the benefits of UGI, remaining knowledge gaps include its long-term effectiveness, scale and context, relationship to equity and social justice, management and maintenance issues, and metrics and evaluation. Other controversies and challenges relate to its implementation, including costs, maintenance, equity issues, effectiveness, and trade-offs.

Methods. The relationship between biodiversity and urbanization was explored using land-use and biodiversity data. The status and dynamics of Eastern European UGI were investigated in relation to different planning systems and, using land-use change data, the dynamics of specific UGI components were ascertained to identify the drivers of change. The same methodology was used to compare the status and dynamics of Bucharest and Chisinau UGI. A GIS-based methodology was developed, adapting a regional-scale one to urban and metropolitan areas to restore UGI and its connectivity, and applied to Bucharest. Potential barriers to planning UGIs, means to overcome them, and ways to expand the UGI were also analyzed. Finally, the results of the Bucharest UGI planning were compared with their potential application to Chisinau.

Results. Findings indicate that UGI is a reservoir of biodiversity, with biodiversity decreasing from natural areas to urban green and urbanized areas. In Eastern Europe, UGI was constantly fragmented and lost. The solution to creating and restoring UGI entails changing the planning system, favoring data-driven approaches and geospatial tools, and involving all actors, especially local ones.

Conclusions. UGI planning remains challenging, but the key lessons include data-driven approaches and cooperation of all actors. The role of UGI is still minimized in the perception of political decision-makers.



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sciforum-172371: Climate-induced seasonal mobilities and the feminization of public spaces: socio-spatial dynamics in the coastal city of Jijel

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The intensification of heatwaves observed over recent decades represents one of the most visible manifestations of climate change, significantly shaping seasonal mobilities and urban practices. In Algeria, these dynamics translate into the growing attractiveness of coastal cities, which are perceived as spaces of refuge from the severe thermal constraints affecting inland and desert regions, particularly during the summer season. These climate-induced seasonal mobilities, situated at the intersection of tourism-related dynamics and the pursuit of environmental comfort, contribute to the temporary reconfiguration of social practices and public space arrangements.

This research examines the repercussions of these flows on the feminization of public spaces through the case of the coastal city of Jijel, one of the main tourist hubs along the Algerian coastline. Drawing on an approach combining in situ observations and research interviews, the study highlights a significant and diversified increase in female presence within public spaces during the summer period. The findings underscore the combined role of tourism dynamics, strategies of social anonymity, and urban attractiveness mechanisms in transforming normative patterns of public space use. This research therefore proposes considering the feminization of public space as a potential indicator of emerging socio-spatial equity processes associated with climate mobilities in contemporary contexts.



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sciforum-172811: From Equality to Equity in a Post-Industrial Mining City: Spatial Disparities in Service Access and Social Protection across Kitwe's Formal–Informal Settlement Continuum

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Introduction: SDG 11 mandates inclusive, safe, resilient, and sustainable cities, yet realisation requires distinguishing equality, uniform resource distribution from equity, calibrating support to differentiated needs. Kitwe's urban fabric includes twenty-four formal and nineteen informal settlements that coexist within one municipal boundary, yet residents experience divergent access to healthcare, education, water, and social protection. With 66% of the population under 25, Copperbelt poverty at 35.9%, and the informal sector absorbing 80–90% of employment, the city constitutes a case for equity-oriented social development in Sub-Saharan Africa.

Methods: A stratified cross-sectional survey across six selected settlements (three formal, three informal) measures healthcare accessibility using a two-step floating catchment area method, education enrolment and completion rates, water and sanitation service levels, and social protection coverage, including the Social Cash Transfer Programme and NHIMA health insurance. A Spatial Equity Index weights indicators by vulnerability prevalence across the formal–informal continuum. Focus group discussions with women, youth, and persons with disabilities capture qualitative exclusion dimensions.

Results: Informal settlement residents travel 2.5–4 times further to access primary healthcare than their formal settlement counterparts, with the national 1:12,000 doctor–patient ratio masking far worse localised ratios in peri-urban zones. Cash transfer coverage, expanded to 880,000 households nationally, shows significant enrolment gaps among mobile urban populations who are ineligible under community-targeting criteria designed for rural contexts. Child stunting in low-income settlements reaches 48% versus 25% in planned areas. The Spatial Equity Index reveals consistent disadvantage gradients correlating with distance from the formal core and proximity to mine waste sites.

Conclusions: Equity-oriented urban social development in Kitwe necessitates spatially targeted, vulnerability-weighted resource allocation that transcends uniform municipal service delivery models. Priority interventions include extending NHIMA coverage to informal populations, establishing satellite health facilities within compound areas, and reformulating cash transfer targeting criteria for mobile urban households to close the persistent equity gap.



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sciforum-175743: Identity and Marginalisation in Urban India: Insights from the Census Data of Delhi

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High rates of migration coupled with exorable rates of urban population growth and the inability of the formal housing market to keep pace with the urban population growth has resulted in the widespread proliferation of slums and squatter settlements in the cities of less developed countries. This is true especially in the case of large metropolises in the world, including metropolitan cities in India. Delhi is one of the megacities in India that houses more than sixty percent of its population in various informal settlements such as slums, unauthorized colonies, resettlement colonies, etc. Studies in the past have shown that the majority of the migrants living in such settlements belong to the socially disadvantaged sections of the society. Moreover, the existing literature, though scant, evinces an association between the identity of the migrants and their location of residence in urban areas. Against this backdrop, the present study examines whether the social identity of migrants plays any role in residential location in Delhi. An analysis of the ward-level Census data of Delhi indicates the prevalence of identity-based residential colonies among socially disadvantaged communities, especially in under-serviced areas of the city such as slums and informal settlements. This study finds that such settlements coupled with their location in the urban outskirts further marginalize their residents, even in the city, thereby reproducing the same kind of inequalities and discrimination in terms of housing they are forced to face in rural settings.



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sciforum-168406: IMPACT OF URBANIZATION ON SOCIAL DEVELOPMENT OF PUNJAB

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As the population grows, cities are expanding rapidly, often at the expense of rural areas and traditional livelihoods. Urbanization is one of the major challenges for growing economies, as unplanned urbanization leads to severe issues such as pollution, climate change, traffic congestion, deforestation, and particularly social disparities including inequality, inadequate access to education and healthcare, and the proliferation of informal settlements. This study will focus on urbanization and its impact on social development in Punjab, examining Punjab-specific indicators such as literacy rates, poverty incidence, access to healthcare, gender parity in education, employment rates, human development index, and social inclusion metrics like access to sanitation and housing in informal settlements. We will use secondary data from national and international sources spanning 1990 to 2024. The Autoregressive Distributed Lag (ARDL) model and Error Correction Model (ECM) will be applied for econometric analysis. This study will also incorporate a climate change index to assess how climate dynamics interact with urbanization and social development processes. The findings are expected to provide valuable insights into how unplanned urbanization influences social mobility, community cohesion, and access to essential services. By identifying key drivers of social development amid urban growth, this study will contribute to the literature on sustainable urban planning and inclusive policies. The outcomes will offer evidence-based recommendations to policymakers for designing strategies that promote equitable social development, mitigate urban inequalities, and enhance resilience to climate challenges.



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sciforum-175772: Integrating Justice into Urban Climate Adaptation: Pathways to Inclusive and Resilient Cities

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Urban climate adaptation strategies increasingly aim to address the rising impacts of climate change, yet many approaches remain technocratic and insufficiently attentive to underlying social and spatial inequities. This paper argues that climate justice must be explicitly integrated into urban adaptation planning to ensure that resilience building does not reproduce or deepen existing disparities but instead fosters more inclusive and equitable urban futures.

Methods: The study employs a mixed-methods approach combining spatial analysis (using GIS and vulnerability mapping), case study comparison, and policy review. Three cities with recent adaptation initiatives in North America and Europe were selected. Quantitative spatial data were used to identify patterns of uneven exposure to climate risks (heat and flooding), while qualitative policy analysis and stakeholder interviews highlighted how adaptation practices include or exclude vulnerable communities.

Results: Findings reveal persistent spatial inequalities in climate exposure and access to adaptation resources, particularly for low-income neighborhoods and communities of color. Current adaptation efforts frequently lack meaningful community participation, leading to procedural injustices. However, cities that integrated participatory adaptation mechanisms, inclusive governance reforms, and nature-based interventions demonstrated improved social outcomes, including greater trust in planning institutions and more equitable distribution of adaptation benefits.

Conclusions: Embedding climate justice principles – including procedural, distributive, and recognitional justice – into adaptation frameworks enhances both resilience and inclusivity. The paper outlines a justice-centered adaptation framework that combines equitable vulnerability assessment, stakeholder co-production, and governance innovation. These insights provide actionable guidance for policymakers and urban practitioners seeking to realize adaptation strategies that are both effective and socially just.



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sciforum-172396: Interpreting Citizen Energy Perceptions through Bivariate Spatial Mapping: Linking Subjective Experience and Urban Context

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Citizen-generated spatial data offer new opportunities to understand how residents perceive the energy and socioeconomic conditions of their living environments. However, translating subjective perceptions into interpretable urban patterns remains methodologically challenging. This study explores how bivariate spatial mapping can be used to reveal alignments and mismatches between perceived conditions and measurable characteristics of the built and social environment.

The analysis is based on citizen-generated geodata collected through a neighborhood crowd-mapping platform developed within the oPEN Lab project, applied to the Rochapea district in Pamplona, Spain. The study area comprises 14 census sections, which led to a combined cartographic and descriptive analytical approach. Two independent bivariate maps were constructed: (1) perceived thermal comfort × energy consumption and (2) housing tenure × income level. Each map followed a 3×3 classification matrix, producing nine perception classes arranged along a theoretical gradient. For each class, mean values of available demographic, socioeconomic, and residential indicators were aggregated from cadastral and official statistical sources. The analysis focused on internal comparisons between classes to detect gradients, discontinuities, and inconsistencies between perception-based categories and contextual indicators.

Energy perception patterns showed a clear association with post-regulatory housing stock and the absence of interior dwellings, suggesting a link between construction standards and perceived comfort. Conversely, socioeconomic perception displayed counterintuitive spatial configurations, where favorable perceived classes did not consistently align with higher official income or newer housing. These discontinuities highlight complex socio-spatial dynamics beyond conventional indicators.

Despite a reduced spatial sample and the participatory nature of the data, including a participation bias (59% women and 53% minors due to school-based engagement activities), bivariate spatial mapping of citizen perceptions provides an exploratory framework to identify concordances and tensions between lived experience and urban structure. The approach supports evidence-informed neighborhood diagnostics and demonstrates the analytical value of participatory geodata for urban energy planning.



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sciforum-175989: Land as an Urban Asset: Territorial Production and Occupation Processes in the Periphery of Santiago, Cusco

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Territorial production in Latin America has historically been understood as the outcome of two dominant social logics: the market and the state. In recent decades, however, a third rationality—the logic of necessity—has become central to urbanization processes. From the articulation between market dynamics and necessity emerges the informal land market, now one of the primary mechanisms through which low-income populations access urban land. Its persistence is closely associated with regulatory frameworks that privilege higher-income sectors, reinforcing institutional barriers to formal housing provision and encouraging irregular land transactions and occupation practices. In spatial terms, these dynamics have fostered patterns of continuous peripheral expansion.

This article examines the land occupation and production processes structuring urban growth in the peri-urban areas of the Santiago district in Cusco, Peru. Within a context of urban–rural transition and limited regulatory enforcement, expansion is shaped by communal decisions regarding progressive land subdivision and informal parceling practices, producing territorially and socially fragmented urban formations.

The research adopts a qualitative case study design developed in three methodological phases: (1) a morphological and cartographic analysis of subdivision patterns on communal land; (2) a review of municipal planning instruments and regulatory frameworks, complemented by direct field observation; and (3) in-depth interviews with communal leaders, land purchasers, and local actors involved in land commercialization. This approach enables the identification of the agents, rationalities, and practices that structure peri-urban expansion and materially configure the urban fabric.

Findings indicate that expansion results not merely from spontaneous occupation but from organized market-oriented processes driven by local actors operating as intermediaries and de facto territorial configurators. In Santiago, urban production precedes formal planning, generating fragmented morphologies and infrastructural deficits. The periphery thus emerges as an actively produced territory shaped by communal and market logics.



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sciforum-172743: Municipal governance and the 2030 Agenda: An analysis of public policies in São Cristóvão, Brazil (2019–2025)

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This study contributes to the interdisciplinary debate on the local implementation of the Sustainable Development Goals (SDGs) by analysing public policies in the municipality of São Cristóvão, Sergipe, between 2019 and 2025. The selected period corresponds to the formal incorporation of the 2030 Agenda into local planning instruments, including the revision of the Master Plan and its integration into multiannual plans and annual budgetary legislation. Although the municipality has gained recognition for sustainability-oriented initiatives and has been referred to as a “Sustainable City,” a systematic assessment of policy coherence and social development impacts remains limited. The research aims to: (i) map municipal programs and actions across the social, environmental, and economic dimensions of sustainable development; (ii) classify these initiatives according to their alignment with the 17 SDGs, with particular emphasis on SDG 11 (Sustainable Cities and Communities); and (iii) evaluate the coherence between implemented policies and municipal sustainability and social development indicators. Special attention is given to how local governance addresses inclusion, equitable access to urban services, and the protection of vulnerable populations. Methodologically, the study adopts a qualitative documentary approach, analyzing official municipal documents produced between 2019 and 2025, including planning instruments, fiscal legislation, and management reports, complemented by a structured literature review on sustainable urban governance. The findings contribute to the debate on the effectiveness of municipal public policies in advancing inclusive, resilient, and sustainable urban development, highlighting both institutional advances and structural constraints in implementing the 2030 Agenda at the local level.



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sciforum-172261: Reading socio-spatial appropriation of public spaces through everyday practices: An observational approach in the city of Jijel, Algeria

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Public spaces in northern Algerian city centers are strongly shaped by a colonial urban legacy that no longer corresponds to contemporary local social practices. Originally designed to meet colonial needs, these spaces now face multiple forms of socio-spatial disengagement. The city center of Jijel, capital of the Jijel province (Algeria), represents a revealing case of the superimposition of colonial spatial structures onto a transformed social fabric with distinct patterns of use.

This study proposes a socio-spatial reading of public space appropriation based on the observation of everyday practices and social interactions within the city center of Jijel. It seeks to understand the underlying socio-spatial mechanisms that generate attraction, avoidance, or selective use of public spaces in this urban context.

The research adopts a mixed observational methodology combining multicriteria evaluation and floating observation. Spatial performances and patterns of use were assessed through a set of quantitative indicators, complemented by qualitative field notes and photographic documentation. Temporal variations were integrated into the analysis through repeated observations across multiple time periods and days of the week.

The results reveal a strong interdependence between spatial configurations, social practices, and everyday temporal rhythms. Rather than being determined solely by physical attributes, public space appropriation appears to be shaped by a combination of spatial conditions, perceived social meanings, and temporal dynamics. Significant contrasts were observed between spaces that support everyday sociability and those that generate forms of avoidance, highlighting the role of socio-spatial coherence in fostering appropriation.

By unveiling these socio-spatial dynamics, this study contributes a transferable analytical framework that can support more context-sensitive urban design and public space planning practices. It provides local urban designers, planners, and decision-makers with insights for improving the adaptability, inclusiveness, and socio-spatial performance of public spaces.



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sciforum-170673: Spatial Differentiation and Multi-Scale Drivers of County-Level Urbanization in China

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Under the framework of new-type urbanization and balanced regional development, counties have become pivotal spatial units linking urban expansion with socio-economic transformation. As fundamental carriers of population redistribution and industrial restructuring, county-level territories play a critical role in shaping China's evolving urban system. However, existing studies primarily focus on prefectural or metropolitan scales and often rely on global or single-scale models, thereby overlooking spatial heterogeneity and scale-dependent effects in urbanization processes. Using county-level data for 2010 and 2020, this study investigates the spatial patterns and temporal dynamics of urbanization rates across China and explores their multi-scale driving mechanisms. First, spatial autocorrelation and distribution characteristics are examined to identify clustering and gradient structures. Subsequently, a Multi-Scale Geographically Weighted Regression (MGWR) model is employed to disentangle the scale-specific effects of natural conditions, economic development, infrastructure provision, demographic structure, and institutional factors. The results reveal that (1) China's county-level urbanization rate increased significantly between 2010 and 2020, exhibiting a persistent east-west gradient and pronounced coastal agglomeration; (2) economic development and transportation accessibility are dominant drivers nationwide, while institutional and policy-related factors demonstrate stronger localized effects in central and western regions; and (3) different explanatory variables operate at distinct spatial scales, highlighting substantial spatial heterogeneity in the mechanisms underlying urbanization. This study contributes to a more nuanced understanding of county-level urbanization within the broader urbanization and social development process and provides empirical evidence for differentiated and place-based urbanization policies aimed at promoting coordinated regional development.



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sciforum-175816: Towards Equal and Equitable Low-Income Homeownership: Unravel Subsidized Housing Adaptation and Homeownership Effect in Bandung Metropolitan Area, Indonesia

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Rapid urbanization in Indonesian cities has significantly shaped the housing landscape, particularly through subsidized housing programs for low-income households. Although these programs have improved access to homeownership, housing equality and equity remain unfulfilled. Inferior housing quality often leads to burdensome outcomes for low-income homeowners who, without feasible alternatives, must adapt to these predicaments. This study aims to explore the experiences of low-income subsidized homeowners by depicting the struggles encountered during the adaptation and the achieved outcomes. Drawing on Priemus' Housing as Social Adaptation framework, the research investigates adaptation beyond structural modifications. Observed outcomes reflect the homeownership effect concept, which consists of financial and well-being aspects. Using a quantitative approach, data were collected from 300 respondents across subsidized housing complexes in the Bandung Metropolitan Area—one of Indonesia's urbanized regions with a high concentration of subsidized housing. Descriptive and cluster analyses were applied to identify homeowner typologies structured by adaptation strategies, outcomes, and related characteristics. Findings indicate a common structural adaptation pattern in maintenance and renovations, while cognitive adaptation, including adjusted housing aspirations, is also evident before and during the occupation. The outcomes correspond to the uncertain nature of the homeownership effect, encompassing both financial and well-being aspects. The identified typologies provide a foundation for program evaluation by proposing tailored homeownership assistance to complement subsidized housing schemes. These findings contribute to advancing housing policy toward greater equality, equity, and fulfillment of housing rights in Indonesia.



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sciforum-172529: Urban Identity under Touristification: The Semiotic Restructuring of Mexico City's Historic Centre

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The pedestrian streets of the Historic Centre of Mexico City are spaces that promote alternative modes of transportation and offer a different way of experiencing the city. It is in these spaces that local and tourist pedestrians interact with the history of the city, perceiving, experiencing, and, in some cases, reinterpreting the landscape. This reinterpretation could be associated with the loss of identity of the local inhabitants due to mass tourism. Our research examines the semiotic landscape of five pedestrianized streets in the Historic Centre of Mexico City, aiming to identify how the landscape has been reinterpreted through language. During 2022, a total of 470 surveys were conducted among residents and pedestrians, revealing a duality between the historical symbols observed and the current predominance of a commercial context. Our findings offer an overview of how symbols and written language on buildings and businesses reflect the impact of mass tourism on historic areas and the powerful way in which it affects residents by modifying their surroundings and interfering with their daily lives, forcing them to reinterpret their landscape. We argue that although tourism is an important part of the economy, it can be managed in a way that respects the identity of inhabitants and historic places.



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sciforum-172062: Urbicide, Memoricide, and the Erosion of Urban Identity: Gaza in Comparative Perspective

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Urban destruction in contemporary conflict is increasingly understood not as incidental damage but as a deliberate strategy targeting the social, cultural, and political foundations of urban life. Drawing on the theoretical frameworks of urbicide and memoricide, this paper examines how systematic violence against the built environment undermines urban identity, collective memory, and the conditions of everyday life. While these concepts have been widely applied to cities such as Sarajevo and Aleppo, Gaza remains underexplored as a primary case within this body of literature. Using a critical literature review, the study synthesizes interdisciplinary scholarship from urban studies, geography, architecture, memory studies, and political theory. It analyzes key theoretical contributions on urbicide, memoricide, place attachment, collective memory, and the right to the city, alongside comparative case studies, to conceptualize urban destruction as spatial, symbolic, and political violence. The findings indicate that urbicide operates through both direct physical destruction and long-term spatial strategies that dismantle heterogeneity, belonging, and coexistence, while memoricide targets cultural memory, heritage, and everyday spatial references. Together, these processes erode place meaning, rootedness, familiarity, and collective identity. Comparative cases suggest that post-conflict reconstruction can partially restore urban life; however, Gaza's condition is characterized by cyclical destruction and suspended recovery, intensifying the erosion of urban identity. The study concludes that urbicide provides a critical lens for understanding urban destruction beyond material loss and highlights a significant gap in sustained, identity-focused analyses of Gaza, underscoring the need to foreground memory, place attachment, and the right to the city in future urban research and planning discourse.



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sciforum-172210: Where Sustainability Meets Experience: A PPGIS Study of Students' Perceptions on a University Campus

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This study applies Public Participatory GIS (PPGIS) to explore students' spatial experiences and perceptions of sustainability on the campus of the University of Pannonia (Veszprém, Hungary), ranked by the UI GreenMetric World University Ranking system. Using the free Map-Me platform, an online participatory mapping survey was conducted in November 2025 among 235 students of the Faculty of Business and Economics. Due to the nature of the free platform, the number of responses to certain questions varied. Respondents identified locations associated with positive experiences and places where sustainability principles are perceived on campus. Spatial data were processed and analysed in QGIS following the exploration–explanation–modelling framework of Fagerholm et al. (2021). Methods included point clustering, heatmap visualisation, buffer and proximity analyses, overlay techniques, and logistic regression modelling to examine the factors influencing positive experiences. Results reveal spatial concentrations of positive experiences primarily near green and communal spaces, while perceived sustainability hotspots only partially overlap with these areas. Proximity to parks and natural features may increase the probability of positive experiences. The findings highlight the importance of green infrastructure and accessible communal areas in shaping students' campus experiences. The study demonstrates the applicability of PPGIS in campus-scale sustainability assessment and provides spatially explicit insights to support evidence-based campus planning and green university development.



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