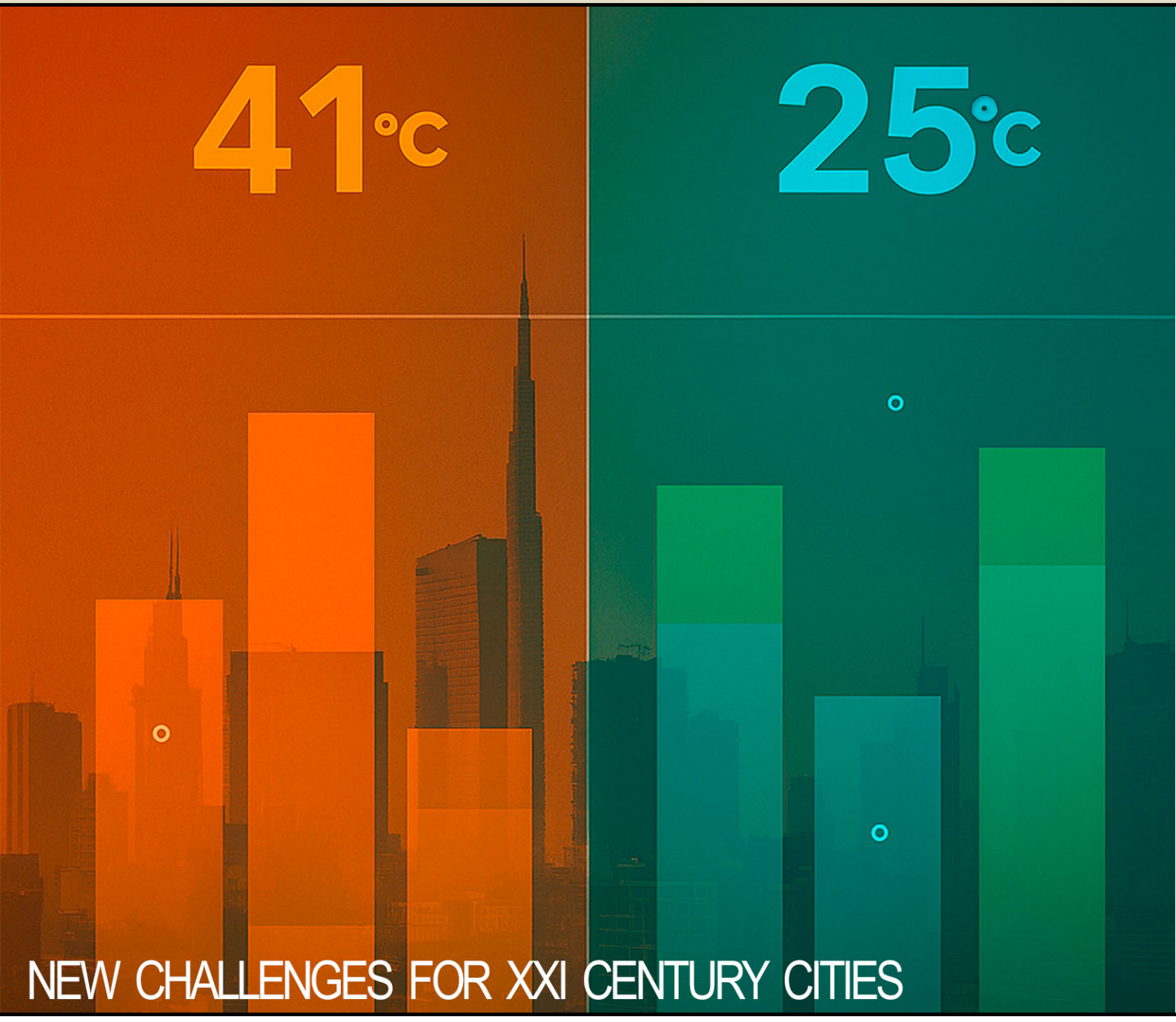
TeMA

18th TeMA Journal
Congratulation on officially becoming an adult
Enjoy your freedom

Journal of
Land Use, Mobility and Environment

print ISSN 1970-9889 e-ISSN 1970-9870
FedOA press - University of Naples Federico II

DOAJ anvur Rivista scientifica di classe A - 08/F1 Scopus WEB OF SCIENCE



NEW CHALLENGES FOR XXI CENTURY CITIES

Multilevel scientific approach to impacts of global warming on urban areas, energy transition, optimisation of land use and emergency scenario

Vol.18 n.3
Dicember 2025

TeMA Journal was established with the primary objective of fostering and strengthening the integration between urban transformation studies and those focused on mobility governance, in all their aspects, with a view to environmental sustainability. The three issues of the 2025 volume of TeMA Journal propose articles that deal with the effects of Global warming, reduction of energy consumption, immigration flows, optimization of land use, analysis and evaluation of civil protection plans in areas especially vulnerable to natural disasters and multilevel governance approach to adaptation.

TeMA is the Journal of Land Use, Mobility and Environment and offers papers with a unified approach to planning, mobility and environmental sustainability. With ANVUR resolution of April 2020, TeMA journal and the articles published from 2016 are included in the A category of scientific journals. The articles are included in main scientific database as Scopus (from 2023), Web of Science (from 2015) and the Directory of Open Access Journals (DOAJ). It is included in Sparc Europe Seal of Open Access Journals, and the Directory of Open Access Journals.

TeMA Journal of
Land Use, Mobility and Environment

NEW CHALLENGES FOR XXI CENTURY CITIES:
Multilevel scientific approach to impacts of global warming on urban areas, energy transition, optimisation of land use and emergency scenario

3 (2025)

Published by
Laboratory of Land Use, Mobility and Environment
DICEA - Department of Civil, Building and Environmental Engineering
University of Naples Federico II, Italy

TeMA is realized by CAB - Center for Libraries at University of Naples Federico II using Open Journal System

Editor-in-Chief: Rocco Papa
print ISSN 1970-9889 | online ISSN 1970-9870
Licence: Cancelleria del Tribunale di Napoli, n°6 of 29/01/2008

Editorial correspondence
Laboratory of Land Use, Mobility and Environment
DICEA - Department of Civil, Building and Environmental Engineering
University of Naples Federico II
Piazzale Tecchio, 80
80125 Naples (Italy)

https://serena.sharepress.it/index.php/tema
e-mail: redazione.tema@unina.it

The cover image was created using an AI tool, taking into account the thematic content of the articles included in this issue.

TeMA - Journal of Land Use, Mobility and Environment offers researches, applications and contributions with a unified approach to planning and mobility and publishes original inter-disciplinary papers on the interaction of transport, land use and environment. Domains include: engineering, planning, modeling, behavior, economics, geography, regional science, sociology, architecture and design, network science and complex systems.
With ANVUR resolution of April 2020, TeMA Journal and the articles published from 2016 are included in A category of scientific journals. The articles published on TeMA are included in main international scientific database as Scopus (from 2023), Web of Science (from 2015) and the *Directory of Open Access Journals* (DOAJ). TeMA Journal has also received the *Sparc Europe Seal* for Open Access Journals released by *Scholarly Publishing and Academic Resources Coalition* (SPARC Europe). TeMA is published under a Creative Commons Attribution 4.0 License and is blind peer reviewed at least by two referees selected among high-profile scientists. TeMA has been published since 2007 and is indexed in the main bibliographical databases and it is present in the catalogues of hundreds of academic and research libraries worldwide.

TeMA Journal of Land Use, Mobility and Environment

NEW CHALLENGES FOR XXI CENTURY CITIES:
Multilevel scientific approach to impacts of global warming on urban areas, energy transition, optimisation of land use and emergency scenario

3 (2025)

Contents

REVIEW NOTES

TeMA Journal of Land Use, Mobility and Environment

TeMA 3 (2025) 593-598
print ISSN 1970-9889, e-ISSN 1970-9870
DOI: 10.6093/1970-9870/12723
Received 30th September 2025, Available online 31st December 2025

http://www.serena.unina.it/index.php/tema

REVIEW NOTES
Urban planning literature review

Exploring open and green space characteristics for climate change adaptation: a focus on energy consumption

Tonia Stiuso

Department of Civil, Building and Environmental Engineering
University of Naples Federico II, Naples, Italy
e-mail: tonia.stiuso@unina.it
ORCID: https://orcid.org/0009-0006-2474-8138

Abstract
Starting from the relationship between urban planning and mobility management, TeMA has gradually expanded the view of the covered topics, always remaining in the groove of rigorous scientific in-depth analysis. This section of the Journal, Review Notes, is the expression of continuously updating emerging topics concerning relationships between urban planning, mobility, and environment, through a collection of short scientific papers written by young researchers. The Review Notes are made of five parts. Each section examines a specific aspect of the broader information storage within the main interests of TeMA Journal. In particular, the Urban planning literature review section presents recent books and journals on selected topics and issues within the global scientific panorama.
For the third issue of TeMA Journal volume no. 18, this section provides a comprehensive overview of the challenges and solutions related to the role of open and green spaces in climate change adaptation, with particular attention to the urban energy consumption. Using a variety of scientific sources and practical resources, this contribution aims to identify the key characteristics of these spaces that can influence adaptation strategies, examining the solutions proposed in the scientific literature, specifically in books, journals, and reports.

Keywords
Open space; Green areas; Literature review; Climate change adaptation; Energy consumption

How to cite an item in APA format
Stiuso, T. (2025). Exploring open and green space characteristics for climate change adaptation: a focus on energy consumption. *TeMA - Journal of Land Use, Mobility and Environment*, *18* (1), 593-598. http://dx.doi.org/10.6092/1970-9870/12723

1. Introduction

In recent decades, the increase in energy consumption in urban areas has become one of the main environmental issues, closely linked to urbanisation processes and climate change. The growth in energy demand for air conditioning in buildings, public lighting, transport and industrial production has led to significant pressure on natural resources and energy infrastructure. Cities are responsible for 66% of global energy consumption and 70% of emissions.

The current energy crisis makes it more imperative than ever to integrate energy saving and efficiency into the governance of urban and territorial transformations, from strategies to tools, at all scales of the city: from buildings to neighbourhoods, from large urban areas to the territory as a whole. In this context, open and green spaces are strategic tools for climate mitigation and adaptation, with direct and indirect effects on reducing urban energy consumption. These benefits include microclimatic regulation of urban green spaces, which reduces ambient temperature and consequently decreases energy demand for cooling buildings, as Zhang et al. explained in 2014. Similarly, good morphological design of open spaces can improve natural ventilation and lighting, thereby boosting energy efficiency in the built environment. The challenge is to translate these ecological benefits into integrated planning strategies that can guide the sustainable development of cities.

Increasing the urban vegetation cover can bring down the average temperatures by 1.07° to 2.9°C. This has enormous implications on energy demand for summer cooling. Marando et al. (2022) contend that a 16% rise in urban green space can be translated into a reduced temperature of approximately 1°C. Green spaces in summer are reported to absorb approximately 3.33×10^{12} kJ of heat through the process of evapotranspiration. This has indeed caused an annual decrease in air conditioning demand of 3.09×10^{8} kWh, hence reducing the CO_2 emissions from power plants by more than 243,000 tonnes (Zhang et al., 2013).

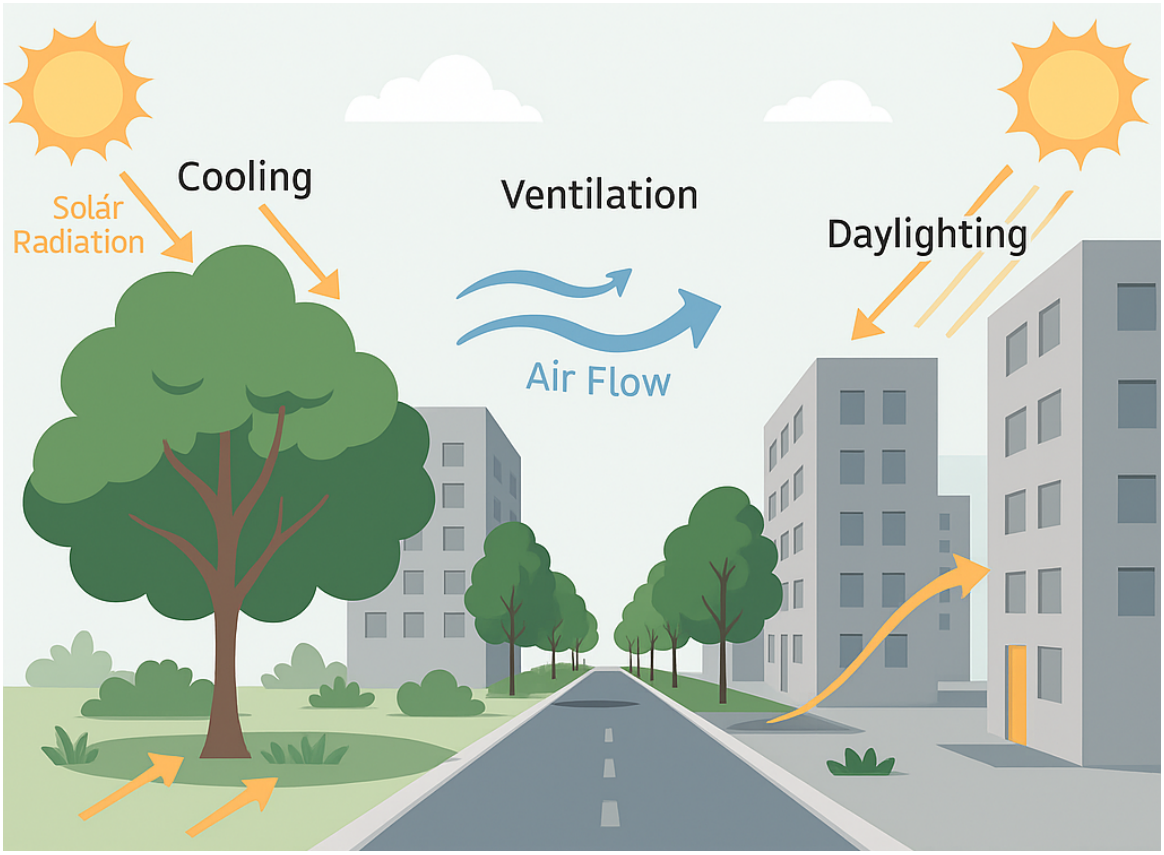


Fig.1 Open Space System in Urban Area with Energy and Thermal Benefit (Generated with AI)

Therefore, it is strategic to adopt a targeted approach to the distribution of greening measures, concentrating them in key areas of the city rather than evenly distributed. This methodology maximizes the benefits in terms of energy savings and emissions reduction, while optimizing costs (Massaro, 2023).

2. Agreements and strategies developed at international level

Climate mitigation and adaptation policies worldwide recognize the role of open spaces as essential elements for urban energy saving (Ascione et al., 2025). The United Nations 2030 Agenda fosters an integrated approach to sustainable urban planning through the Sustainable Development Goals, especially Goal 11 (Sustainable Cities and Communities) and Goal 13 (Climate Action) (United Nations, 2015). Finally, the Paris Agreement of 2015 summed up the commitment of the signatory states in reducing emissions and fostering energy efficiency thanks to urban adaptation measures.

Low-carbon urban planning relies on the principle that open and vegetated spaces can play a very important role in energy demand reduction and mitigation of the urban warming effect. The European Union's Strategy on Adaptation to Climate Change and the Biodiversity Strategy for 2030 place green infrastructure at the center of urban regeneration policies. These are implemented through the support of several local and international financing and planning instruments that foster resilient and sustainable cities.

First and foremost among these is the European Green Deal, presented in 2019, which represents the roadmap of the EU with respect to achieving climate neutrality by the year 2050. The focus of its main priorities is on contributing to a circular economy, reduction of emissions, and greening solutions. In urban areas, the Green Deal promotes the increase of green spaces, energy efficiency of buildings, and sustainable mobility.

These investments will be realized through urban reforestation programs, green roofs, ecological corridors, and infrastructure for sustainable rainwater management.

Another tool is Horizon Europe, 2021-2027, the principal European programme in the field of research and innovation that finances projects for sustainability and energy saving.

Among its most important missions for urban planning are:

- Climate-Neutral and Smart Cities: will help transform at least 100 European cities into climate-neutral ecosystems by 2030.
- Adaptation to Climate Change: Develop solutions not only to manage extreme weather conditions but also reduce energy consumption by reconfiguring open spaces.
- It fosters biodiversity and ecosystem services, hence encouraging the conservation and proper utilization of natural resources within city settings.

Fig.2 Horizon Europe Portal Banner

LIFE Programme operational since 1992 is the EU financial instrument dedicated to the environment and climate action. In the 2021-2027 programming period, LIFE supports projects that integrate energy efficiency and climate mitigation measures by promoting green and blue infrastructure. Typical interventions involve the redevelopment of disused urban areas through the transformation and greening of open spaces, improving the energy resilience of public spaces, and providing innovative technologies for the sustainable management

of energy and water resources. Ministry of Environment and Energy Security 2024. Besides thematic programs, the ESIF and NRRP represent additional financial support instruments.

In principle, in many countries - such as Italy - NRRP resources are committed to creating green infrastructures, energy upgrading of public buildings, and ecological transition of cities.

3. Morphological characteristics of open spaces and their role during flooding events

Urban morphology has a decisive influence on the energy behavior of a city. Open spaces, squares, car parks, and internal courtyards have in common the function of regulating the microclimate due to three basic mechanisms: Evapotranspiration: plants release moisture into the atmosphere, contributing naturally to the cooling of the air, while reducing the thermal load on buildings. Shading: trees and vegetation protect artificial surfaces, reducing the absorption of solar radiation.

Finally, natural ventilation: the distribution of open spaces allows for and improves air circulation, enhancing thermal comfort while diminishing the demand for air conditioning.

The morphological characteristics which most influence energy benefits include:

- the size and continuity of green areas;
- the existence of trees;
- the integration of water features such as fountains or ponds;
- soil permeability, and the use of reflective materials;
- the orientation of the structures in relationship to predominant wind patterns.

4. Conclusions

Open and green spaces are not only elements that connect the urban fabric, but also fundamental tools for energy consumption reduction and adaptation to climate change.

Scientific literature also confirms that an integrated approach in urban planning, environmental design, and green infrastructure management can lead to significant energy benefits.

NBS integrated into urban transformation strategies contribute to reducing energy demand for cooling and heating, improving citizens' quality of life through better microclimatic comfort. In order to maximise these benefits, though, the promotion of coordinated policies at both a local and supra-local level is needed, with increasing adaptive planning practices and continuous energy result monitoring. The future of sustainable cities is linked to being able to conceive open space as an active energy infrastructure that is fundamental to strategies of adaptation to climate change.

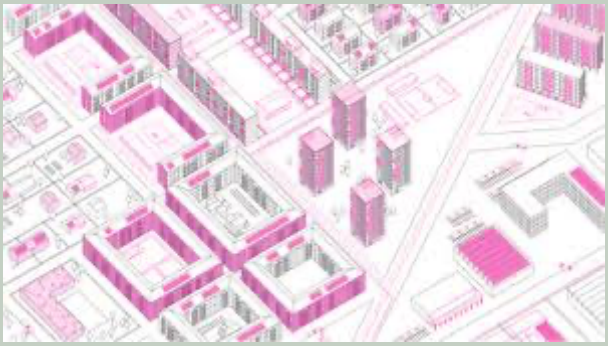
UNEP Copenhagen Climate Centre (CCC)

UNEP-CCC
UNEP Copenhagen Climate Centre

Il UNEP Copenhagen Climate Centre (CCC) è un centro di eccellenza che promuove soluzioni energetiche efficienti e basate sulla natura per affrontare le sfide climatiche globali. In risposta alle ondate di calore record, il CCC sostiene tecnologie a basso consumo energetico e infrastrutture verdi per ridurre le emissioni e rafforzare la resilienza urbana. Collabora con enti internazionali per proteggere i più vulnerabili, migliorare la qualità dell'aria e favorire uno sviluppo sostenibile.

Retrieved from: https://unepccc.org/urgent-call-to-action-leveraging-energy-efficiency-and-nature-based-solutions-amid-record-heatwaves/

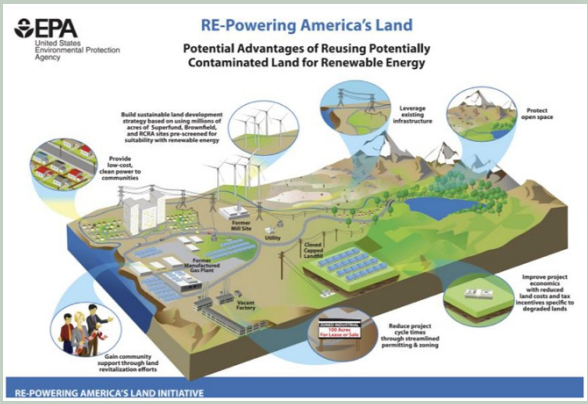
From Energy Renovation to Urban Renovation



Lo studio pubblicato da Agenzia delle Entrate esplora come gli strumenti finanziari per l'efficienza energetica possano essere utilizzati per rigenerare il tessuto urbano. L'approccio proposto mira a superare la scala del singolo edificio, promuovendo interventi integrati su spazi pubblici e privati. Il documento evidenzia il potenziale di sinergie tra finanza pubblica e investimenti privati per migliorare la qualità urbana.

Retrieved from: https://www.agenziaentrate.gov.it/portale/documents/20143/325307/From+energy+renovation+to+urban+renovation+Davide+Rolfo_CaneparoRolfo_ing.pdf/3ecbe591-dd8d-7880-1e70-eddb210d30af

Re-powering the Nature-Intensive Systems



L'articolo propone un approccio innovativo per collegare gli interventi di permeabilizzazione negli spazi aperti con la transizione energetica. Attraverso l'analisi di concetti comuni come capitale naturale, servizi ecosistemici e infrastrutture energetiche, il lavoro evidenzia il potenziale dei sistemi accoppiati NbS-ET per affrontare le sfide urbane e ambientali. Il contributo offre una base teorica utile per sviluppare strategie integrate di sostenibilità.

Retrieved from: https://www.frontiersin.org/journals/sustainable-cities/articles/10.3389/frsc.2022.860914/full

References

Ascione, L., Gargiulo, C. & Guida, C. (2025). A systematic review of climate action plans: A focus on urban green spaces for adaptation and energy saving. In O. Gervasi et al. (Eds.), *Computational Science and Its Applications - ICCSA 2025 Workshops*, Lecture Notes in Computer Science, 15890, 106-121. Springer Nature Switzerland. https://doi.org/10.1007/978-3-031-97606-3_8

Camerin, F., Álvarez-Del-Valle, L., Díez-Bermejo, A. & Rodríguez-Suárez, I. (2024). Towards the Spanish local urban agenda: The evolution of urban regeneration in Spain (2014-2022). *TeMA - Journal of Land Use, Mobility and Environment, 17* (1), 51-70. https://doi.org/10.6093/1970-9870/10338

Caneparo, L. & Rolfo, D. (s.d.). From energy renovation to urban renovation. Agenzia delle Entrate. Retrieved from: https://www.agenziaentrate.gov.it/portale/documents/20143/325307/From+energy+renovation+to+urban+renovation+Davide+Rolfo_CaneparoRolfo_ing.pdf/3ecbe591-dd8d-7880-1e70-eddb210d30af

Council of the European Union. (2020). *Biodiversity*. Retrieved from: https://www.consilium.europa.eu/it/policies/biodiversity/

European Commission (2019). The European Green Deal. https://commission.europa.eu/strategy-and-policy/priorities-2019-2024/european-green-deal_it

European Commission (2021). *Building a climate-resilient future - A new EU strategy on adaptation to climate change* [Press release]. Retrieved from: https://ec.europa.eu/commission/presscorner/detail/it/ip_21_663

European Commission (2021). *Reference documents - Horizon Europe (2021-2027)*. EU Funding & Tenders Portal. Retrieved form: https://ec.europa.eu/info/funding-tenders/opportunities/portal/screen/how-to-participate/reference-documents;programCode=HORIZON

Giannakidou, A. & Latinopoulos, D. (2023). Identifying spatial variation in the values of urban green at the city level. *TeMA - Journal of Land Use, Mobility and Environment, 16* (1), 83-104. https://doi.org/10.6093/1970-9870/9290

He, Q., Tapia, F. & Reith, A. (2023). Quantifying the influence of nature-based solutions on building cooling and heating energy demand: A climate specific review. *Renewable and Sustainable Energy Reviews, 186*, 113660. https://doi.org/10.1016/j.rser.2023.113660

Marando, F., Heris, M. P., Zulian, G., Udías, A., Mentaschi, L., Chrysoulakis, N., Parastatidis, D. & Maes, J. (2022). Urban heat island mitigation by green infrastructure in European Functional Urban Areas. *Sustainable Cities and Society, 77*, 103564. https://doi.org/10.1016/j.scs.2021.103564

Massaro, E., Schifanella, R., Piccardo, M. et al. (2023). Spatially-optimized urban greening for reduction of population exposure to land surface temperature extremes. *Nat Commun* 14, 2903. https://doi.org/10.1038/s41467-023-38596-1

Ministero dell'Ambiente e della Sicurezza Energetica (2024). *Programma LIFE*. Retrieved from: https://www.mase.gov.it/portale/programma-life

Pultrone, G. (2023). The city challenges and the new frontiers of urban planning. *TeMA - Journal of Land Use, Mobility and Environment, 16* (1), 27-45. https://doi.org/10.6093/1970-9870/9392

Razzaghi Asl, S. (2022). Re-powering the nature-intensive systems: A conceptual framework for coupling nature-based solutions and energy transition. Frontiers in Sustainable Cities, 4, Article 860914. Retrieved from: https://www.frontiersin.org/articles/10.3389/frsc.2022.860914/full

UNEP Copenhagen Climate Centre (2023). Urgent call to action: Leveraging energy efficiency and nature-based solutions amid record heatwaves. Retrieved from: https://unepccc.org/urgent-call-to-action-leveraging-energy-efficiency-and-nature-based-solutions-amid-record-heatwaves/

UNFCCC (2015). *Accordo di Parigi*. Framework Convention on Climate Change. Paris: United Nations.

UN (2015). *Trasformare il nostro mondo: l'Agenda 2030 per lo Sviluppo Sostenibile*. New York: United Nations General Assembly.

Zhang, B., Xie, G., Gao, J. & Yang, Y. (2014). The cooling effect of urban green spaces as a contribution to energy-saving and emission-reduction: A case study in Beijing, China. *Building and Environment, 76*, 37-43. https://doi.org/10.1016/j.buildenv.2014.03.003

Author's profile

Tonia Stiuso

She is an engineer and research fellow at the Department of Civil, Architectural and Environmental Engineering at the University of Naples Federico II. Her research currently focuses on the theme of urban sustainability, in particular the study of gender inequalities and adaptation to climate change.