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CITIES AS SOCIAL ECOLOGICAL SYSTEMS

BOOK OF ABSTRACTS



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Biuro Organizacji Konferencji
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Fundacja UAM w Poznaniu
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e-mail: bok@ppnt.poznan.pl

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The adoption of Performance-based Planning for setting urban design parameters against climate changes. An urban cooling application in Milano city

Silvia Ronchi^{1*}, Stefano Salata², Andrea Arcidiacono¹

¹ Department of Architecture and Urban Studies, Politecnico di Milano, via Bonardi 3, Milano 20133, Italy

² Department of City and Regional Planning, Izmir Institute of Technology, Gülbahçe Kampüsü Urla 35430, Türkiye

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*e-mail: silvia.ronchi@polimi.it

The rapid urban expansion connected to the increase of world's population lives in urban areas (a proportion that is expected to reach 68 % by 2050) [1,2] have caused an increase of pollution and air/surface temperatures of cities differently from the rural surrounding areas. These dynamics characterised cities exacerbating the Urban Heat Island (UHI) effect, a phenomenon further worsened by global warming. Contemporary cities are strongly affected by the UHI phenomenon, which is becoming one of the most significant climate change-related hazards with huge consequences for health and human well-being

The research investigates the contribution of urban green areas in mitigating and reducing the UHI effect in a highly urbanised context: the city of Milan (Lombardy region, north-west Italy). The city is the second-most densely populated in Italy with 7,641.45 inhabitants/sq km [3] and is situated at the core of an extensive socio-economic and settlement system, namely, the Metropolitan Region of Milan.

An empirical study was conducted to verify how the Cooling Capacity (CC) of ecosystems is related to urban design parameters, such as the density, quantity and height of buildings, the presence of green areas with vegetation, the rate of imperviousness of materials, and other morphological criteria. CC is seen as one of the most fundamental urban Ecosystem Services (ES) with multiple health benefits. The study – already published in *Sustainable Cities and Society* journal [4] presenting a challenge for dense anthropic areas affected by climate change with enormous consequences for health and human well-being. Ecosystem Services (ES – shows how adopting an ES-based approach could support the definition of urban design parameters and criteria for mitigating heatwaves effect while decreasing high temperatures in urban areas and enhancing territorial resilience.

The CC assessment was developed using the urban ES models of InVEST software (Integrated Valuation of Ecosystem Services and Tradeoffs, version 3.8.5) [5].

The mapping and assessment of CC were associated to some historical periods of the city of Milan, attributable to specific “urban planning seasons”, aiming to verify the adoption of specific urban design that can have contributed to the microclimatic regulation and urban comfort. The

historical planning periods include i) Beruto's city, late 19th century; ii) Modern city, early 20th century; iii) 60 s–70 s city, late 20th century; and iv) Contemporary city, 21st century.

Empirical findings demonstrate what are the main Urban design parameters that influence the CC of the city. The Territorial utilisation index usually defines as estimating the impact of an urban transformation derived by the building expansion of cities; it is not a key variable in defining a climate-proof city, while the footprint and the distribution of the gross floor areas are much more relevant. In fact, from the study emerges that it is more important to design compact green areas and not fragmented ones to maximising the cooling efficiency. Moreover, urban parks can provide tangible CC benefits if the compact green surfaces are at least 2 ha in size. Lastly, instead of fixing a minimum quantity of trees for green areas, it is more important to select trees species with high shadowing capacity, thus maximising the canopy during the hot season. Tree cover has a major influence on tree density, highlights the importance of selecting tree species.

These results reinforce the recent developments and approaches on rethinking the Urban planning standard system according to a quantitative parameter and its qualitative dimension using design solutions based on ecosystem performances. The study allows integrating ES consideration in the Planning process, solving one of the key lack that still today limits the adoption of ES into land-use planning and decision-making processes

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