A multi-level Thermal Comfort Assessment (TCA) to identify and mitigate heat stress risks in urban areas

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A multi-level Thermal Comfort Assessment (TCA) to identify and mitigate heat stress risks in urban areas

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The liveability of cities worldwide is under threat by the predicted increase in intensity and frequency of heatwaves and the absence of a clear spatial overview of where action to address this. Heat stress impairs vital urban functions (Böcker and Thorsson 2014), hits the local economy (Evers et al. 2020), and brings risks for citizens' health (Ebi et al. 2021). The ongoing densification of cities may escalate the negative consequences of heat, while rising climate adaptation ambitions require new pathways to (re)design public places for a warmer climate. Currently, policy makers and urban planners rely on remote sensing and modelling to identify potential heat stress locations, but thermal comfort models alone fail to consider socio-environmental vulnerabilities and are often not applicable in different countries (Elnabawi and Hamza 2020).

In the Cool Towns Interreg project, researchers collaborated with municipalities and regions to model urban heat stress in nine North-Western European cities, to find vulnerabilities and to measure on the ground (see Spanjar et al. 2020 for methodology) the thermal comfort of residents and the effectiveness of implemented nature-based solutions. Using the Physiological Equivalent Temperature (PET) index, several meteorological scenarios were developed to show the urban areas under threat. The PET maps are complemented by heat vulnerability maps showing key social and environmental indicators. Coupled with local urban planning agendas, the maps allowed partner cities to prioritize neighbourhoods for further investigation. To this end, community amenities and slow traffic routes were mapped on top of the PET maps to identify potential focus areas.

A comparative analysis of the collated maps indicates certain spatial typologies, where vital urban activities are often influenced by heat stress, such as shopping areas, mobility hubs, principal bicycle and pedestrian routes. This project has resulted in the development of a multi-level Thermal Comfort Assessment (TCA), highlighting locations where vulnerable user groups are exposed to high temperatures. Standardized for European cities, it is a powerful tool for policy makers and urban planners to strategically identify heat stress risks and prioritize locations for adapting to a changing climate using the appropriate nature-based solutions.

Keywords: Heat Stress, Climate Change Adaptation, Physiological Equivalent Temperature (PET), Heat Vulnerabilities, Nature-Based Solutions

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