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Street green space for urban heat reduction: a globally-relevant, local climate zone-specific empirical assessment

Giacomo Falchetta[1,2], Steffen Lohrey[1,3], Niels Souverijns[4], Carl-Friedrich Schleussner[1,5], and Leila Niamir[1]

[1]International Institute for Applied Systems Analysis, ECE Program, Laxenburg, Austria (falchetta@iiasa.ac.at)
[2]Euro-Mediterranean Center on Climate Change, Venice, Italy
[3]Sustainability Economics of Urban Settlements, Technische Universität Berlin, Berlin, Germany
[4]Flemish Institute for Technological Research (VITO), Mol, Belgium
[5]Geography Department and IRI THESys Institute, Humboldt-Universität zu Berlin, Berlin, Germany

Urban transformative adaptation is increasingly crucial to minimize the adverse impact of climate change, also in the context of the ongoing global urbanization. Street green space (SGS) represents a key strategy in the solution space due to its capacity to reduce urban heat burden through shade and evapotranspiration. Yet, estimating the cooling efficiency of street trees is highly dependent on the location-specific climate zone, the within-city differences in urban form, as well as on the data and metrics used to measure the urban microclimate and green space density. Moreover, the bulk of previous studies have used remotely sensed land-surface temperature, the use of which is widely criticized for quantifying heat stress.

Here we conduct a 100-meter resolution empirical assessment in a globally relevant pool of cities and with a local climate zone (urban form) within-city stratification to re-evaluate the role of street green space in adapting to urban heat in different urban contexts. We measure local heat load using different metrics (wet-bulb globe temperature (WBGT), and average, maximum and minimum 2-meter air temperature), which are calculated from the hourly output of the UrbClim urban climate model for 143 cities across the world, and we use estimates of the Green View Index (GVI) as a street-based measure of tree canopy cover.

Using random-effects regression models and controlling for a set of confounding factors in the statistical relation (such as population density, water bodies, and buildings height), we find that street green space is an effective strategy to reduce urban heat, but its effectiveness is highly context- specific, depending on both the local climate and the urban form. Our results can serve to inform the global discourse on transformative change of cities to achieve both adaptation goals (e.g. by reducing health impacts of urban heat or the risk caused by urban hydrological hazards), as well as energy use reduction and emission mitigation targets (e.g. cooling energy needs), also in the light of the upcoming IPCC AR7 special report on cities and climate change.