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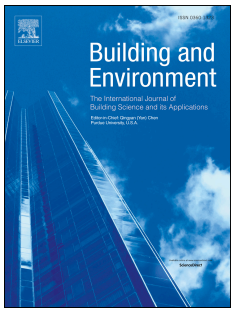

Planning strategies for roadside tree planting and outdoor comfort enhancement in subtropical high-density urban areas

Zheng Tan, Kevin Ka-Lun Lau, Edward Ng

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Abstract

Hot summers in the subtropics cause thermal discomfort, which is intensified by the urban heat island effect in heavily built-up areas. Use of urban greenery has been proposed as a mechanism for microclimate regulation. In this study, the microclimatic effect of urban trees was investigated in the context of high-density cities in subtropical hot and humid climates. Measurements were conducted in urban areas with sky view factors (SVF) ranging from 0.2 to 0.8, and mean radiant temperatures were calculated. The measurements show that the effects of urban trees are related to SVF and that the impact of building morphology is more evident under cloudy conditions than under sunny conditions. In heavily built-up areas, the mean radiant temperature (T_{mrt}) was reduced to a comfortable level (33°C) by roadside trees in the early afternoon. Simulation results indicate that roadside trees reduce the physiological equivalent temperature (PET) to 29°C in urban areas with SVFs of 0.2 under cloudy conditions. The SVF-oriented planning method was tested using the existing building geometry of two high-density districts of Hong Kong, Mong Kok and Sham Shui Po, and site-specific design strategies for tree planting were developed. The study results show that a comfortable microclimate can be provided by roadside trees in heavily built-up urban environments in subtropical cities for nearly 70% of the summer. Design suggestions for refining the Green Master Plans of Hong Kong in future planning are provided.

Keywords: urban greenery, sky view factor, outdoor comfort, high-density urban areas