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Tobi Eniolu Morakinyo, Kevin Ka-Lun Lau, Chao Ren, Edward Ng



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Performance of Hong Kong's Common Trees Species for Outdoor Temperature Regulation, Thermal Comfort and Energy Saving

Tobi Eniolu MORAKINYO^{1*}, Kevin Ka-Lun LAU¹, Chao REN¹² and Edward NG¹²

¹ Institute of Future Cities, The Chinese University of Hong Kong, New Territories, Hong Kong

² School of Architecture, The Chinese University of Hong Kong, New Territories, Hong Kong

*Corresponding author: tobimorak@cuhk.edu.hk

Abstract

Using a validated ENVI-met model, a parametric study was conducted to investigate the thermal and energy saving benefits in a selected neighbourhood with its current greenery coverage ratio (GCR) of 7.2%, compared to the recommended 30%. To provide information for efficient tree species selection, nine scenarios were tested for the case of 30% GCR. In eight of them, only one tree species was used in each case. The trees represent the eight most common species in Hong Kong. The remaining one featured a mix of tree species.

In comparison with the reference case (no trees), results revealed a reduction in maximum temperature of 0.4°C and 0.5 – 1.0 °C under the current and 30% GCR situations respectively; and a decrease in average Physiological Equivalent Temperature of 1.6°C and 3.3 – 5.0 °C . The area coverage of “Very Hot” thermal sensation reduced from ~60% in the reference case to ~50% with the current GCR and 17 – 21% with 30% GCR. Lastly, a decrease in cooling energy of 1500 kWh per typical summer day was observed with the current GCR, which increased to ~1900 – 3000 kWh with 30% GCR, equivalent to 200 – 450 US\$ savings within the 500 m² domain. The variations in the estimated benefits between the 30% GCR scenarios reflect the importance of species-specific analysis. Statistical analysis revealed leaf area index was the main driver of the observed benefits, followed by trunk height, tree height and crown diameter. Our findings will encourage city planners and citizens to take actions for urban greening.

Keywords: Temperature regulation, energy saving, thermal comfort, tree species, ENVI-met

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