AN EXPLORATIVE STUDY ON THE POTENTIAL OF GREEN ROOFS PROVIDING THERMAL COMFORT CONDITIONS FOR INDOOR SPACES IN KUMASI, GHANA

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ABSTRACT

Purpose

As the global population keeps increasing with its associated urbanisation and climate change issues being experienced in various degrees worldwide, there is the need to find mitigating measures to improve thermal conditions within spaces. The study aimed to evaluate green roofs to determine whether they could provide thermal comfort within residential buildings.

Design/methodology/approach

Forty-two-year weather data were retrieved from the Kumasi weather station to establish the pattern of the climatic variables. Furthermore, an experiment was conducted by constructing test cells to determine the potential of vegetation/green roofs on temperature development within spaces. This approach led to a simulation-based exploration of the thermal performance of the test cells to probe variables that could lead to the reduction in temperature after the models in the software (design-builder) had been validated.

Findings

The results on the 42 years (1976–2018) weather data showed a significant ($p = 0.05$) mean temperature increment of 2.0 °C. The constructed test cell with Setcreasea purpurea (Purple Heart) vegetation showed an annual mean temperature reduction of 0.4 °C ($p = 0.05$). In addition, the exploration using the simulation application showed combinations of various soil depth (70–500 mm) and leaf area indices (leaf area index of 2–5) having a potential to lower indoor temperature by 1.5 °C and its associated reduction in energy use. The option of green roofs as a valuable alternative to conventional roofs, given their potential in mitigating climate change, must be encouraged. A survey of occupants in six selected neighbourhoods in Kumasi showed varying subjective perceptions of several green issues (24–98%) and increases in temperature values because of the loss of greenery in the city.

Originality/value

Empirical data that point to the significant reduction of indoor temperature values and a subsequent reduction in energy use have been unearthed. Therefore, built environment professionals together with city authorities could invest in these sustainable measures to help humanity.

KEYWORDS: Urban heat Island, Green roof, Thermal comfort, Simulation, Urbanisation