Manchester Geographical Society

Funding Report

Skygardens: the potential of balconies in Manchester as sites of urban greening

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Introduction

The multiple benefits of urban greenspace are well documented, with street trees and parks providing local cooling, flood prevention, air pollution capture and stress reduction (Nyelele *et al.*, 2019). Recent research, however, highlights the contribution that can be made from domestic garden owners (Cameron *et al.*, 2012). Private gardens in Manchester comprise 20 % of the land area, however, there are great spatial inequalities, with the city centre and neighbouring wards having only 0.5 to 13 % (Cavan *et al.*, 2021). These central areas are instead dominated by high-rise residential buildings which often feature an alternative form of outdoor domestic space – the balcony.

This was a pilot study in collaboration with the National Trust, who offered residents of selected apartment blocks resources and expertise towards creating mini gardens on their balconies through their Sky Gardening Challenge. Ultimately, the National Trust hope to use balcony gardening as a way to improve people's access to and connection with nature in cities. The research component aimed to assess the psychosocial benefits of greening balconies (improved mental health) alongside physical benefits such as reducing local temperatures in summer (shade and evapotranspiration), capturing air pollution and enhancing biodiversity. The extent and locations of balconies across the city were also assessed in order to aid upscaling of localised findings. This short report will focus on the temperature aspect.

Methods

A field monitoring campaign was set up with temperature and humidity sensors (provided with funds from MGS) on 16 balconies arranged in 8 pairs of green and non-green balcony matched as much as possible by location, height, and aspect. The paired balcony approach allows for robust statistical comparisons to be made. The sensors (Tinytag II) were placed within small Stephenson shields to prevent direct solar heating of the apparatus (Figure 1), and made recordings every 15 minutes. The monitoring period ran from the end of May to mid July 2024 in order to capture some warm, summer days.

On the green balconies, estimates of percentage cover by plants were made.

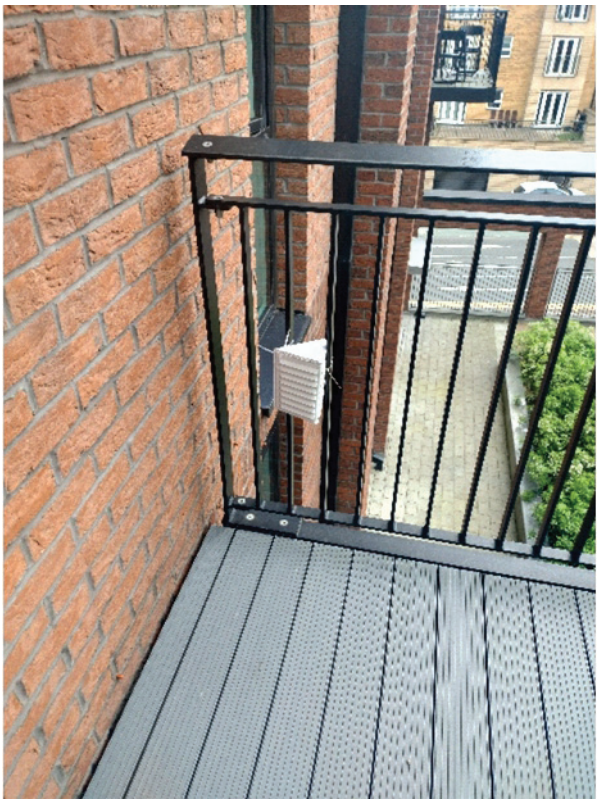

Figure 1: A Stephenson shield containing a temperature and humidity sensor installed on a non-green balcony.

Results

The green balconies that were monitored mostly had lower air temperatures and higher humidity than bare balconies with differences being greater during the afternoon. Specifically, regarding data for the whole monitoring period, it was observed that in 6 out of the 8 balcony pairs, temperatures were lower on average on the green balconies with a mean average difference of 0.5oC. Relative humidity was higher on 7 out of the 8 pairs, with the average difference being 2 %. There was no correlation between the percentage coverage of green and cooling effect.

The cooling effect was generally greatest during the warmer parts of the day (Figure 2). A further statistical test compared average hourly temperatures between balcony pair members, focussing on a warm, sunny day (26th June). Paired t-test results showed that there were significant differences between bare and green balconies from 12 noon to 14:00 (t-test –1.2 to –1.38, p = 0.02 to 0.03).

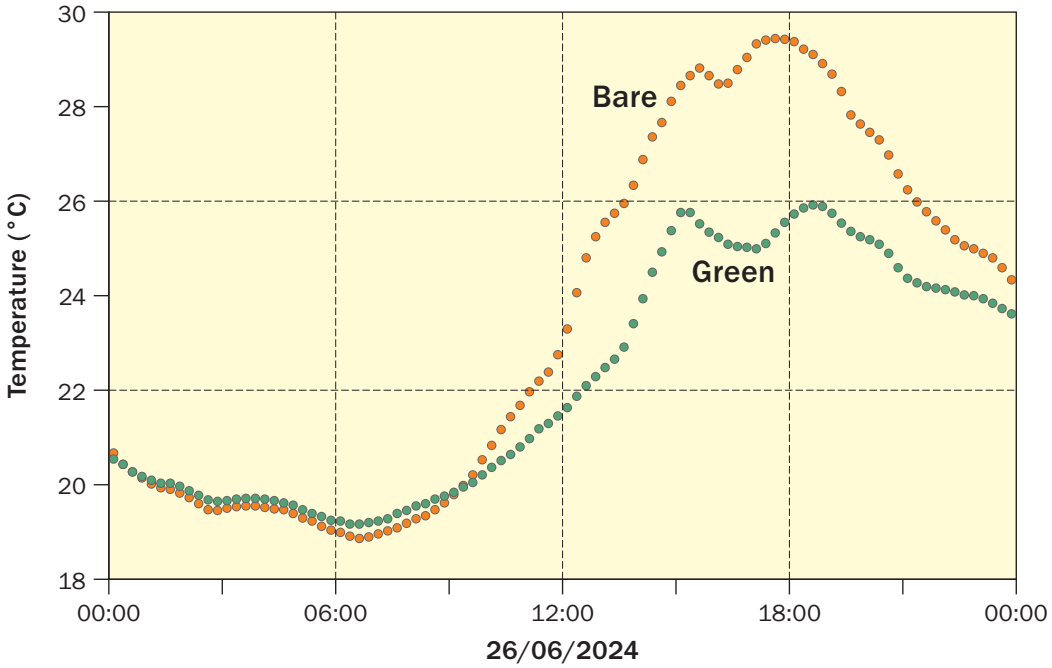

Figure 2: Air temperature profiles for a bare/green balcony pair on a warm day.

Conclusion

The results point to promising evidence of local microclimate modification from urban balcony greening in Greater Manchester, with benefits for individuals and wider communities. The vegetation will shade balconies directly, preventing absorption and re-radiation of solar radiation, and the plants and soils will provide evapotranspirative cooling of the air mass within the balcony and potentially beyond. There appears to be evidence for evapotranspiration with the lower air temperatures and higher humidity on green balconies.

As a pilot study, there are several limitations that came to light which would need to be overcome for a full research project. The main limitation of the monitoring campaign was the low number (eight) of balcony pairs that were available for installation of equipment. Statistical robustness could be increased with more participants but this is difficult to achieve given the sensitive nature of gaining repeated, albeit brief, access to participants' private home spaces. Additionally, there was no control over the amount of green on balconies, with some participants having just a couple of pots with small plants. Very small-scale planting may not be expected to proffer many physical environmental benefits, at least during the Sky Gardening Challenge itself. Greater benefits are to be expected where a larger proportion of the city's balconies are greened.

References

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