The effect of Urban Green Structures on Thermal Comfort

Comparing court yards in Potsdam, Germany

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Summary

- **Urban green infrastructure is increasingly being promoted as a measure to mitigate urban heat stress caused by the heat island effect and climate change impacts.**
- **Evidence of the effectiveness of urban green infrastructure to moderate heat stress is mostly lacking.**
- **We measured temperature, relative humidity and wind speed during July-September 2019 in four courtyards with a similar built environment but varying green structures in Potsdam, Germany.**
- **First results show a significant difference in maximum air temperatures with lower temperatures in greener courtyards.**

Context

Weather extremes such as heat waves and heavy rainfall are increasing. Ecosystem-based measures are believed to be a promising option to tackle climate adaptation but evidence for their mictoclimatic effect is scarce.

Objective

We aim to show significant differences in thermal comfort between four courtyards that have a similar built environment but vary in the amount and diversity of green structures.

Garden City of Potsdam-Drewitz, Germany

Potsdam-Drewitz was built in the 1980s as one of the last large housing estates in the German Democratic Republic, today it comprises approx. 3000 flats. In 2009, the biggest housing society in the area began reconstruction on their buildings according to energy efficiency standards. In line with the garden city movement, large parts of the sealed surfaces (street, parking lots) were converted to a large park and green structures were added to a few court yards (Fig. 1 and 2).

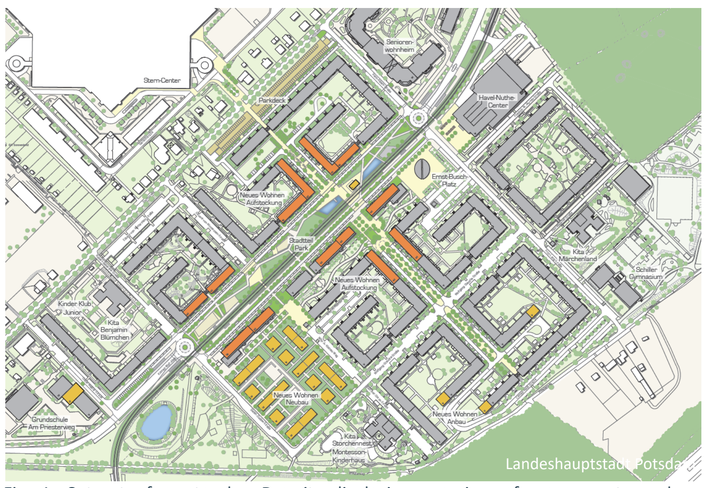

Fig. 1. Cut-out of masterplan Drewitz displaying overview of measures towards energy efficient reconstruction of buildings and green structures

Fig. 2A. View on main road before the street conversion to a park, 2B. View on main road after street conversion

Methods

From 09 July to 07 September 2019 we measured air temperature, wind speed, and relative humidity in four court yards with similar built structures but varying green structures (Fig. 3). We installed meteorological stations according to spatial conditions and where they would best represent the microclimate of the court yard. We selected two court yards with more green structures (MGS) and two court yards with less green structures (LGS; Fig. 4)

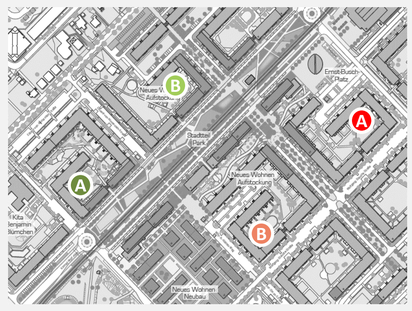

Fig. 3 Location of meteorological stations (green shading = more green structures, red shading = less green structures)

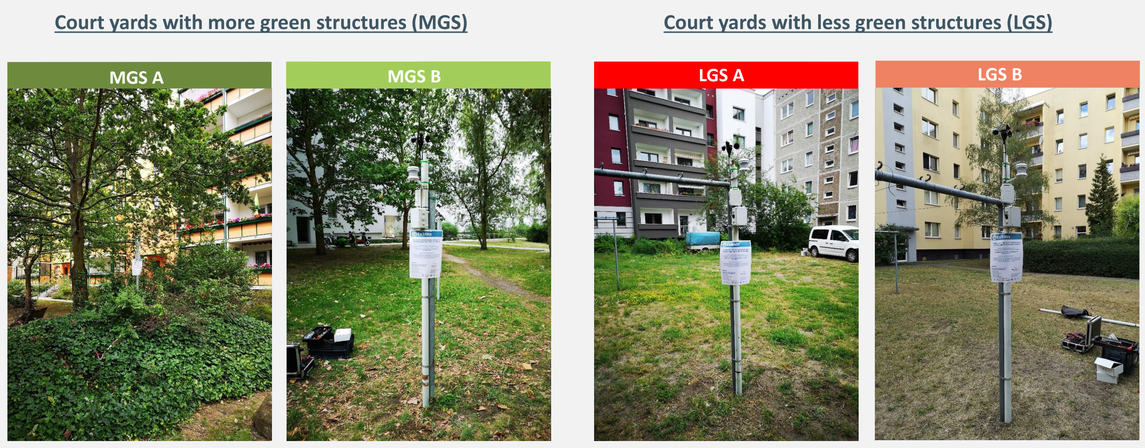

Fig. 4 Meteorological stations in court yards with more green structures (MGS) and less green structures (LGS; Photos: Katja Schmidt)

Results of microclimatic measurements

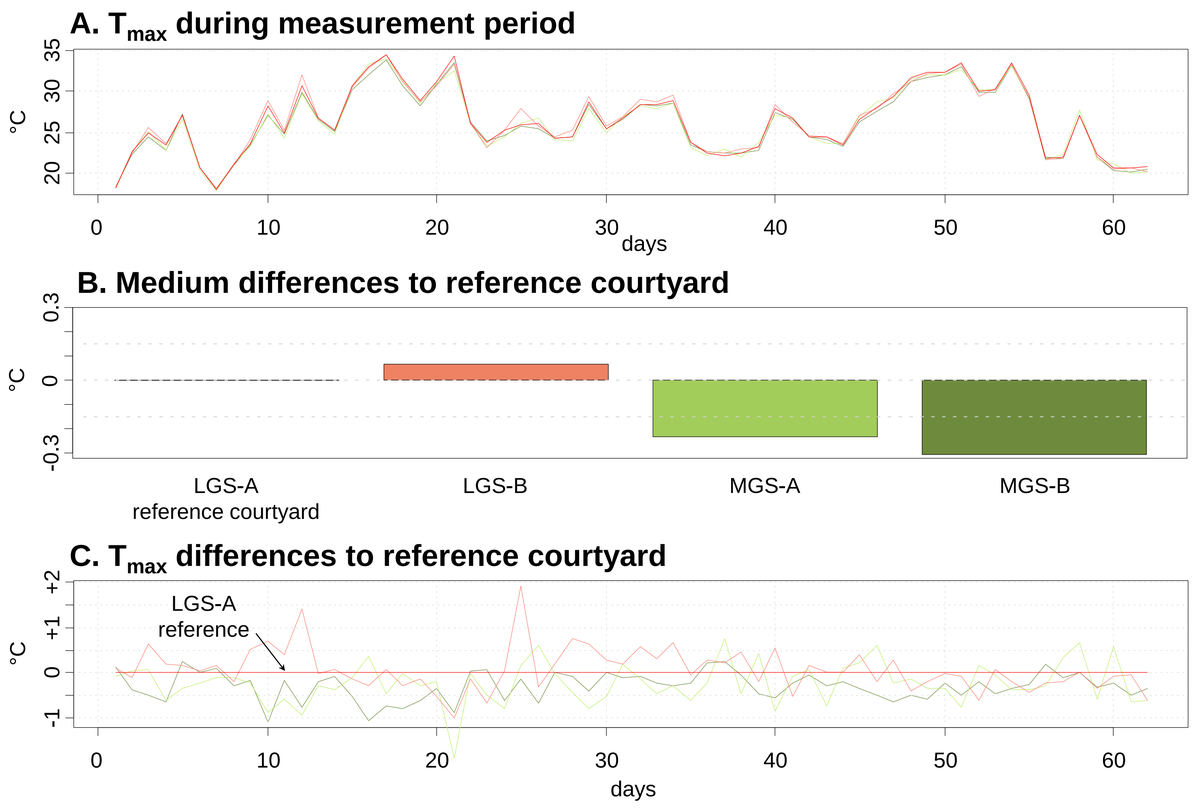

Fig. 5. Results of air temperature measurements; A. Tmax during measurement period, B. Medium differences to reference court yard, C. Tmax differences to reference court yard

- We find court yards with more green spaces (MGS) have signficantly cooler air temperatures when we calculate differences to one reference court yard (Fig. 5B).
- Wind speed and relative humidity do not differ significantly between court yards.
- First results (without the consideration of global radiation) indicate no statistically significant differences in thermal comfort (i.e. PET) between the four courtyards.

Lessons learnt | Way forward

- We will equip our meteorological stations with sensors for global radiation for further measurements in 2020.
- We find courtyards with more green spaces (MGS) have signficantly cooler air temperatures which can potentially lead to better urban health.
- We will investigate further co-benefits of urban green, i.e. biodiversity, carbon sequestration, and benefits for human well-being in 2020.

GEFÖRDERT VOM
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