A strategic approach for climate change adaptation via green infrastructure at neighbourhood scale

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Preferred session: Urban biodiversity versus functional design of urban ecosystems?

Cities are expected to experience heat days in summer more frequently and with higher intensity due to climate change. Urban green infrastructure can help cities to adapt to climate change by providing regulating ecosystem services. Therefore, municipal planning should foster policies and activities for so-called ecosystem-based adaptation. However, municipalities need to be supported by more information and better guidance as to the extent and type of green infrastructure measures they should implement. How much green is needed to avoid heat stress under current and future's climate? How effective are different measures?

Against this background, this study aims to increase our understanding of the regulating effects of different green infrastructure settings under a future climate change scenario. The study contributes to the research project "Climate mitigation and green infrastructure" and is part of the "Urban Ecology and Climate Adaptation" programme funded by the Bavarian Ministry of the Environment and Consumer Protection. The overall project aims to develop integrated strategies for climate change mitigation and adaption. To this end, it combines research into energy efficiency of residential neighbourhoods with research into the role of green infrastructure for regulating microclimates and how these are linked one to the other. Not least, the project explores how additional green infrastructure can be integrated into three different types of neighbourhood – perimeter blocks, free standing multistorey blocks and an old town centre – to simultaneously enhance biodiversity and open space quality for the residents.

This paper presents the results from the systematic exploration of different types of green infrastructure on outdoor thermal comfort under current and climate change conditions. Based on a scenario modelling approach, the cooling potential of green roofs, green facades and tree plantings during hot summer days for varying green volume as well as current and future climate conditions are assessed. The research applies the urban microclimate model ENVI-met for a case study located in the city centre of Munich, Germany, representing a typical urban fabric of perimeter blocks, which is commonly found in both German and European cities. Air temperatures and physiological equivalent temperature PET were used for comparison. The results show which greening measure has the highest potential to regulate the urban microclimate during day and night time as well as today and in the future. Thereof, we concluded how much greening needs to be implemented to effectively mitigate climate change impacts and increase outdoor thermal comfort conditions. The potential to enhance biodiversity and open space quality via a combination of different measures will be discussed. Following from this, a guideline for urban planners is developed, supporting them in choosing the most effective combination of green infrastructure measures suitable for their respective situation.

(440 words)