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Green infrastructure strategies for climate change in urban areas

Introduction

Urban green infrastructure (UGI) offers various benefits for climate change adaptation, notably by reducing the urban heat island effect and stormwater runoff, increasing thermal comfort for outdoor recreation and promoting biodiversity; for climate change mitigation by reducing cooling energy demands and carbon sequestration. Still these different goals are rarely considered together in urban planning. The **Centre for Urban Ecology and Climate Adaptation**, funded by the Bavarian Ministry of the Environment and Consumer Protection, seeks to address these challenges in an inter- and transdisciplinary approach with partners from two Bavarian cities. The project aims to develop integrated strategies for climate change mitigation and adaptation which are supported by evidence from rigorous scientific study.

Research Approach

The benefits of UGI for outdoor as well as indoor thermal comfort and buildings' energy demand are assessed by a novel **modelling approach** coupling microclimate modelling with thermal building simulation. The microclimate modelling software **ENVI-met** is used to simulate the surface-plant-air interaction in an urban neighbourhood. We use the model to analyse outdoor thermal comfort conditions in different **urban greening scenarios for seven typical days** during the course of a year. The scenarios differ in the share of green space by implementing measures like roof and façade greening, tree plantings and parks. In order to evaluate the effect of these scenarios on indoor thermal comfort and buildings' energy demand, we employ **IDA-ICE**, a building performance simulation tool, and couple it with the modelling outputs of ENVI-met. The meteorological output of the typical days forms the basis for calculating buildings' energy demand and summing up the results to a yearly balance.

Type 1
Perimeter block
Munich Maxvorstadt

Type 2
Multistorey blocks
Munich Neuaubing

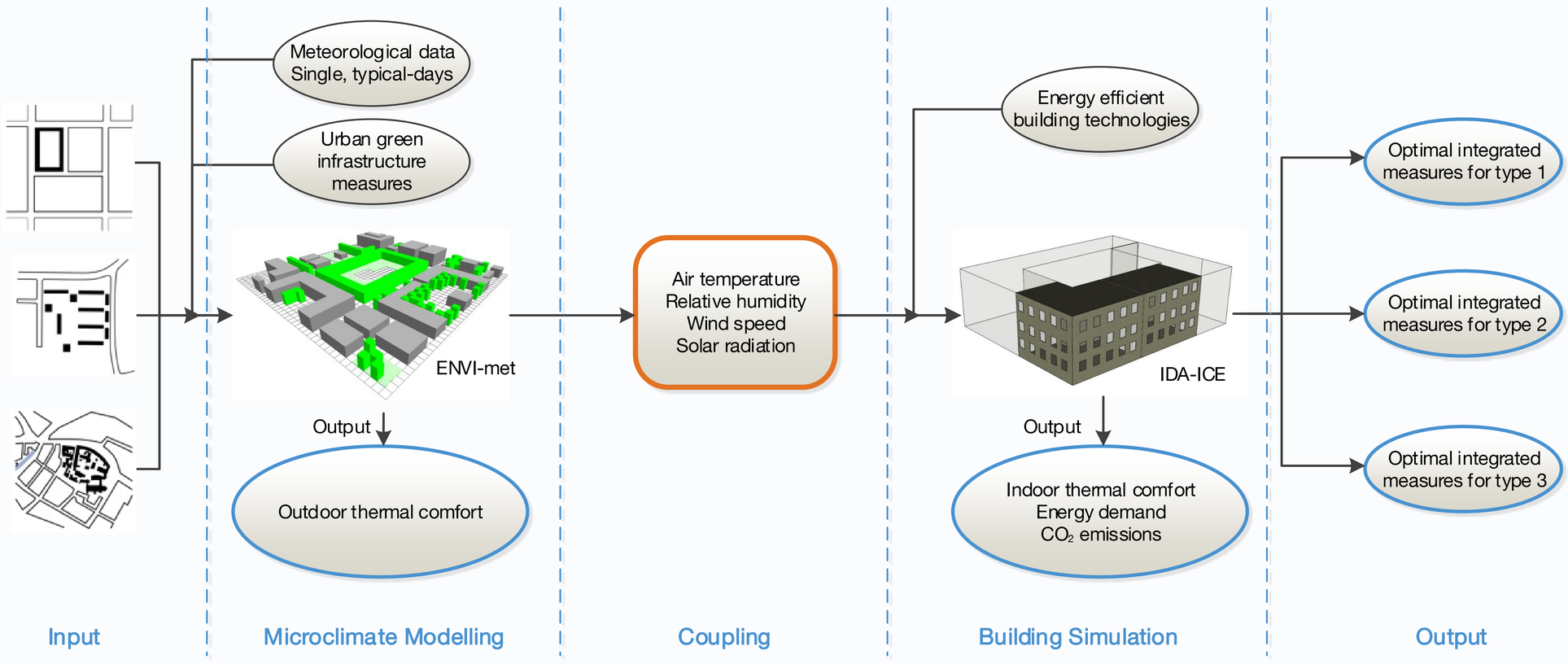
Type 3
Historic centre
Würzburg Heidingsfeld

Types of urban fabrics selected for analysis

A **multi-criteria decision making approach** will inform on which UGI scenario should be prioritised because it shows the largest benefits for mitigation and adaptation simultaneously. Further criteria for assessment will include dimensions of quality of life and biodiversity. The approach is applied in typical urban fabrics within two Bavarian cities, Munich and Würzburg.

Conclusion and Outlook

Results show the varying effectiveness of UGI scenarios in reducing thermal loads in outdoor and indoor spaces and the energy demand at building level during hot summer days. They provide evidence for effective integration of mitigation and adaptation planning at urban neighbourhood scale. Results are expected to serve as decision support for urban planners and the city administration to realize implementation of UGI measures. The paper will present the conceptual framework for this research and discuss the synergies and trade-offs for climate change mitigation and adaptation of different UGI strategies.



Conceptual framework of research (own draft)

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