



Diagnosing local deficits and mitigation suitability for neighborhood-scale urban heat adaptation in Hesse

Susanne A. Benz¹, Mathias Jehling², and Sina Keller¹

¹Karlsruhe Institute of Technology, Department of Civil Engineering, Geo and Environmental Sciences, Institute of Photogrammetry and Remote Sensing, Karlsruhe, Germany (susanne.benz@kit.edu)

²Leibniz-Institut für ökologische Raumentwicklung, e.V. (IOER), Urban Structure and Policy

Urban heat adaptation policies often rely on hotspot analyses to prioritize areas of concern, yet such maps provide limited guidance on why specific locations are vulnerable and which actions are most appropriate at the neighborhood scale. To support local decision-making, fine-scale diagnostic information on strengths and deficits is required before local goals can be assigned. And once goals are defined, suitable mitigation measures must be selected to achieve them, often under a regional policy and funding framework that requires transparent prioritization.

We present a stepwise assessment framework that connects these levels from strategic prioritization to actionable planning. Building on an existing multi-criterion hot and cold spot prioritization, we derive diagnostic profiles for each urban 100-m grid cell across the German state of Hesse. These profiles summarize local strengths and deficits in goal-relevant dimensions such as vegetation condition, tree presence, and available open space, and are communicated for each grid cell through compact spider plots that enable rapid interpretation and comparison between locations.

In a subsequent step, diagnosed deficits and locally assigned goals are linked to measure-specific suitability maps for five common urban heat mitigation options: unsealing, tree-based shading, vegetation improvement, green facades, and green roofs. Suitability is derived from combinations of land-cover characteristics, vegetation metrics, and urban structural indicators, explicitly accounting for local constraints such as built-up density, parcel structure, and urban typology. The resulting scores allow a consistent comparison of mitigation options within and between neighborhoods. By mapping these suitabilities across the study region, the framework supports both neighborhood-scale decision-making and region-wide analyses of where specific measures are most feasible, providing an evidence base for targeted investment and long-term climate resilience strategies.