

Assessment of Microclimate in Abu Dhabi Neighborhoods: On the Utilization of Native Landscape in Enhancing Thermal Comfort

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Abstract : Urban population is continuously increasing worldwide and the speed at which cities urbanize creates major challenges, particularly in terms of creating sustainable urban environments. Rapid urbanization often leads to negative environmental impacts and changes in the urban microclimates. Moreover, when rapid urbanization is paired with limited landscape elements, the effects on human health due to the increased pollution, and thermal comfort due to Urban Heat Island effects are increased. Urban Heat Island (UHI) describes the increase of urban temperatures in urban areas in comparison to its rural surroundings, and, as we discuss in this paper, it impacts on pedestrian comfort, reducing the number of walking trips and public space use. It is thus very necessary to investigate the quality of outdoor built environments in order to improve the quality of life incites. The main objective of this paper is to address the morphology of Emirati neighborhoods, setting a quantitative baseline by which to assess and compare spatial characteristics and microclimate performance of existing typologies in Abu Dhabi. This morphological mapping and analysis will help to understand the built landscape of Emirati neighborhoods in this city, whose form has changed and evolved across different periods. This will eventually help to model the use of different design strategies, such as landscaping, to mitigate UHI effects and enhance outdoor urban comfort. Further, the impact of different native plants types and native species in reducing UHI effects and enhancing outdoor urban comfort, allowing for the assessment of the impact of increasing landscaped areas in these neighborhoods. This study uses ENVI-met, an analytical, three-dimensional, high-resolution microclimate modeling software. This micro-scale urban climate model will be used to evaluate existing conditions and generate scenarios in different residential areas, with different vegetation surfaces and landscaping, and examine their impact on surface temperatures during summer and autumn. In parallel to these simulations, field measurement will be included to calibrate the Envi-met model. This research therefore takes an experimental approach, using simulation software, and a case study strategy for the evaluation of a sample of residential neighborhoods. A comparison of the results of these scenarios constitute a first step towards making recommendations about what constitutes sustainable landscapes for Abu Dhabi neighborhoods.

Keywords : landscape, microclimate, native plants, sustainable neighborhoods, thermal comfort, urban heat island

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