GOBESHONA
Global Conference 3
Monitoring Locally - Led Adaptation & Resilience

Managing heat in the urban environment in a warming world

Urban microclimate in Dhaka: Findings from field measurements and remote sensing.

Tania Sharmin[1] [2]

The built-environment and urban form have a significant impact on urban microclimate. By devising the correct urban form, urban planners and designers can play a crucial role in mitigating the adverse impacts of urban warming and urban heat island (UHI) effect. The arrangement of buildings, roads, and other urban elements can affect the microclimatic variables such as air temperature, humidity, wind speed, radiant temperature, and air quality. For example, the orientation of buildings, aspect ratio (building height to street width ratio), sky view factor (SVF) and other urban geometry features can influence the amount of solar radiation (its absorption, reflection, and emittance) and wind that reaches urban areas affecting the air temperature, mean radiant temperature and air flow patterns. We have examined the environmental performance of different urban morphology in Dhaka using the Local Climate Zone (LCZ) classification. Our findings suggest, urban forms that are more variable with irregular plot sizes and building heights, mostly in traditional areas, have positive responses with respect to the synoptic climate, while planned areas with uniform plot sizes and height, shows a tendency to develop daytime UHI effect. An east-west orientated street in a formal residential area was found to be 1^0C - 3.8 ^{0}C warmer than a street in a traditional residential area in the same orientation. An outdoor thermal comfort survey conducted alongside microclimate measurements revealed that pedestrians in the formal planned areas or less diverse traditional areas were less comfortable than those in the more variable areas. In a more recent study, we have produced the LCZ map for Dhaka to identify which built-environment and landcover categories perform better in terms of UHI, land surface temperature (LST) and Normalized Difference Vegetation Index (NDVI). Our findings show that UHI, LST and NDVI varied significantly across the LCZ classes. High-density built-up areas showed more UHI, while LCZ-11 reported none. For built-up-LCZs, lower vegetation cover and higher building density represented higher LST, and natural-LCZs represented lower LST than built-up-LCZs, except LCZ-16. These findings are crucial for devising appropriate urban planning and design strategies to reduce the UHI impact and improve the overall microclimate and thus help to improve public health, lower heat-related illness, reduce energy consumption, and finally, enhance the quality of life for urban residents.

[1] Princeton Institute for International and Regional Studies (PIIRS), Princeton University
[2] Welsh School of Architecture, Cardiff University