Humidity increases urban heat stress

As global temperatures continue to rise, urban areas are facing increased levels of heat stress. While cities are generally warmer and drier than rural areas, in the Global South, humidity represents another complicating factor. By using observational data and an urban climate model calculation, a team of scientists led by Yale University has recently investigated the combined impact of temperature and humidity on urban heat stress.

The analysis revealed that heat stress is highly dependent on local climate, and humidity can erase the cooling effect that would come from trees and other vegetation.

“A widely held view is that urban residents suffer more heat burden than the general population owing to the urban heat island phenomenon. This view is incomplete because it omits another ubiquitous urban microclimate phenomenon called the urban dry island – that urban land tends to be less humid than the surrounding rural land,” said study senior author Xuhui Lee, a professor of Meteorology at Yale.

“In dry, temperate, and boreal climates, urban residents are actually less heat-stressed than rural residents. But in the humid Global South, the urban heat island is dominant over the urban dry island, resulting in two to six extra dangerous heat stress days per summer.”

Since a large percentage of the population currently lives in urban settings (about 55 percent of the world’s population), and many people do not have access to air conditioning while temperatures continue to rise, clarifying which factors affect urban climates is necessary.

According to the experts, urban land modifies both air temperature and air humidity, which have equal weight in heat stress as measured by the so-called “wet-bulb temperature index,” which does not weigh temperature more heavily than humidity as other heat indexes.

These findings raise a series of important questions. “Green vegetation can lower air temperature via water evaporation, but it can also increase heat burden because of air humidity. The question then is to what extent this humidifying effect erases the cooling benefit arising from temperature reduction. We hope to answer this question in a follow-up study, where we are comparing observations of the wet-bulb temperature in urban greenspaces (with dense tree cover) and those in built-up neighborhoods,” said Lee.

Further research is needed to find efficient ways of mitigating heat stress in urban settings. “Our diagnostic analysis on the urban wet-bulb island found that enhancing urban convection efficiency (the efficiency in dissipating heat and water) and reducing heat storage at night can reduce daytime and nighttime urban humid heat, respectively. We hope that our work will promote more research on optimizing urban shapes and materials for better thermal comforts,” concluded lead author Keer Zhang, a PhD student in Environmental Sciences at Yale.

The study is published in the journal *Nature*.

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