Cooling warming cities

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How to cool American cities

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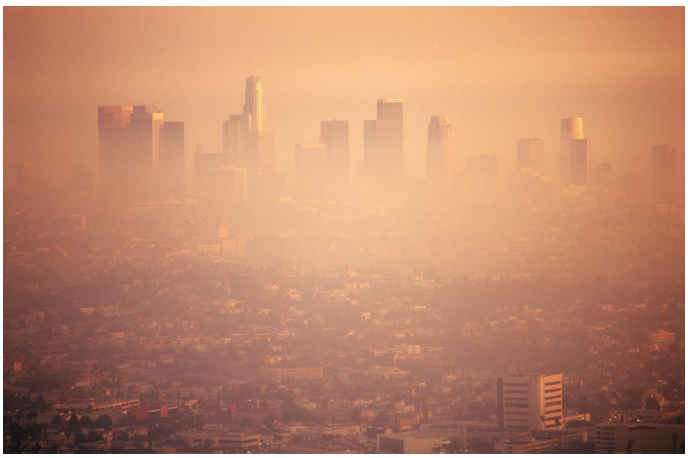
Climate change is worsening heat waves across American cities. New research compares the benefits of urban infrastructure adaptation — such as the addition of trees and parks to cities — with those of reducing greenhouse gases on the effectiveness of cooling US cities.

The summer of 2023 repeatedly blanketed American cities in unprecedented heat, marking it the hottest summer in US history. According to the latest climate projections, summer 2023 pales in comparison with the regularity and intensity of heat waves that US cities will face in the future. But how we can best cool US cities and reduce heat exposure in the coming decades is unclear. In this issue of *Nature Cities*, Matei Geogescu, from Arizona State University, and colleagues develop a methodology to answer this question[1].

For the 260 million Americans who live in cities, heat exposure is not increasing solely due to climate change. The concentration of concrete and asphalt combined with heat-producing activities like driving, air conditioning and industrial production, also elevate urban air temperatures. This is known as the urban heat island effect. The confluence of climate change and the urban heat island effect, together with urban population growth, is leading to a rapid increase in the number of urban residents exposed to dangerous heat, not just in the USA but worldwide[2]. To minimize the level of harm generated from urban heat exposure, we need to rapidly reduce greenhouse gas (GHG) emissions (that is, carry out climate mitigation) and invest in changes in urban infrastructure such as the building of cool roofs and the planting of more urban trees (that is, carry out climate adaptation).

Geogescu and colleagues assess the comparative cooling benefits of climate adaptation and climate mitigation for all US cities. To do this, they integrate urban land and population projections out to 2100 with hourly weather simulations and long-term climate projections. The novelty of their study is that they measure the cooling potential of adaptation and mitigation independently and in tandem across the full geographic diversity of US cities.

They show that all US cities will face greater heat exposure in the future without adaptation and mitigation. But the maximum possible benefits of adaptation and mitigation, independently and combined, vary spatially across the country's diverse climate gradient for both daytime and night-time urban heat exposure. For instance, while the new study's results suggest that decreasing GHGs provides a greater reduction in future urban heat exposure for all cities, climate adaptation may be more beneficial for northern US cities than for southern US cities. These findings affirm that location matters. Communities must invest in cost-effective and locally appropriate adaptations. But the greatest reduction in urban heat exposure, irrespective of geography, will be achieved by deploying both adaptation and mitigation in tandem.



Climate change and the urban heat-island effect are rapidly warming cities across the USA.

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While their methodology and findings are innovative, Georgescu and colleagues do not address the complexity of how we define 'heat exposure'[3]. Climate scientists tend to focus on percentile-based changes in air temperature, as this study does. However, heat exposure results from the complex interactions between air temperatures, humidity, solar radiation and wind speeds[4]. Some adaptations may actually make urban heat exposure worse. As the authors note, reflective surfaces designed to reduce air temperature can reflect heat up at urban residents, elevating heat stress. Similarly, the urban heat island effect is affected by humidity[5]. In some locations, efforts to green cities may produce swelteringly humid conditions and worsen urban heat exposure.

Furthermore, it is not clear if mitigation and adaptation will reduce harm from heat exposure for vulnerable populations in US cities. We know that historically marginalized Americans face the greatest burden from heat exposure in the USA, as in many other regions. For instance, because of discriminatory housing policies like redlining, racial minority communities fare worse during heat waves and have reduced access to urban cooling adaptations like green spaces.

Thankfully, this research is being published as policies are shifting. The Inflation Reduction Act (IRA) is curbing US GHG emissions through investments in clean energy. The Biden Administration's Justice 40 Initiative aims to guarantee that 40% of federal investment will go to underserved communities. Through the IRA, the US Department of Agriculture launched a US $1 billion grant program to develop urban green spaces in minority communities. Further, federal efforts to create labour standards to reduce heat stress can also minimize harm.

Along with infrastructure adaptation and mitigation, there are other ways to reduce harm from urban heat exposure. The United Nations Early Warnings for All Initiative aims to protect everyone worldwide from heat waves. Such warning systems can help the public, policymakers, emergency responders and medical clinicians prepare for

heat waves. Timely health information and visualization tools — like the US Department of Health & Human Services' Climate and Health Outlook and the National Integrated Heat Health Information System — can improve health literacy and public trust, which is one challenge noted by the World Health Organization[6]. This information can prepare health professionals[7] to combat infodemics and help allocate resources for expected surges in hospital services during heat waves. Reducing harm from urban heat exposure also requires training on up-to-date clinical guidelines for managing patients with heat-related illnesses, including rapid cooling, cold-water immersion and supportive care with fluid and electrolyte repletion[8].

With 2023 on course to be the hottest year on record, Geogescu and colleagues provide timely and new information to help decide where to focus limited resources to combat climate-change impacts on US cities: adaptation or mitigation? A cost–benefit assessment is the natural extension of this work. Future work can potentially extend these methods to all cities worldwide and target resources to produce locally appropriate results.

There are no silver bullets with climate change. But with concerted efforts to reduce emissions and to tailor adaptations, we can reduce harm caused by urban heat exposure for each city on the planet. This paper provides a starting point for such global efforts.

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Competing interests

The author declares no competing interests.