Planting more trees could decrease deaths from higher summer temperatures in cities by a third, modeling study suggests

January 31 2023

Credit: Pixabay/CC0 Public Domain

One third of premature deaths attributable to higher temperatures in European cities during summer 2015 could have been prevented by

increasing urban tree cover to 30%, reveals a modeling study published in *The Lancet*. The study also found that tree cover reduced urban temperatures by an average of 0.4 degrees during the summer.

"We already know that high temperatures in urban environments are associated with negative health outcomes, such as cardiorespiratory failure, hospital admission, and premature death. This study is the largest of its kind, and the first to specifically look at premature mortality caused by higher temperatures in cities and the number of deaths that could be prevented by increasing tree cover," says lead author, Tamar Iungman, Barcelona Institute for Global Health.

"Our ultimate goal is to inform local policy and decision-makers about the benefits of strategically integrating green infrastructure into urban planning in order to promote more sustainable, resilient and healthy urban environments and contribute to climate change adaptation and mitigation. This is becoming increasingly urgent as Europe experiences more extreme temperature fluctuations caused by climate change; despite cold conditions currently causing more deaths in Europe, predictions based on current emissions reveal that heat-related illness and death will present a bigger burden to our health services over the next decade."

Urban environments record higher temperatures than the surrounding countryside generally referred to as "urban heat islands." This temperature difference is caused by human modification of landscapes, such as removal of vegetation, the presence of asphalt and use of building materials that absorb and trap heat. As emissions continue to exacerbate climate change and global heating, increased temperatures in cities are predicted to become more intense, resulting in an increasingly urgent need for cities to adapt to improve health outcomes.

The researchers estimated mortality rates of residents over 20 years old

in 93 European cities between June and August 2015, accounting for 57 million inhabitants in total. Mortality data from this period was analyzed with daily average city temperatures in two modeling scenarios: the first comparing the city temperature without urban heat islands to city temperature with urban heat islands, and the second simulating the temperature reduction as a consequence of increasing the tree cover to 30%. Exposure response functions were used to estimate the number of deaths attributable to urban heat as well as the number of deaths that could be prevented through increasing the tree cover.

The population-weighted city average daily temperature difference between cities and countryside from June—August 2015 was 1.5 degrees warmer than the surrounding countryside, with the maximum temperature difference measured at 4.1 degrees hotter in Cluj-Napoca, Romania. Across all cities, 75% of the total population lived in areas with an average summer city temperature difference greater than one degree, and 20% with an average summer temperature difference greater than two degrees, compared to the surrounding countryside.

In total, 6,700 premature deaths could be attributed to hotter urban temperatures during the summer months, accounting for 4.3% of summer mortality and 1.8% of year-round mortality. One in three of these deaths (2,644 total) could have been prevented by increasing tree cover up to 30%, and therefore reducing temperatures. This corresponds to 39.5% of all deaths attributable to hotter urban temperatures, 1.8% of all summer deaths, and 0.4% of year-round deaths.

There was a large variability in temperature-related mortality rates between cities, from no premature deaths attributable to hotter urban temperatures in Goteborg, Sweden, to 32 premature deaths per 100,000 people in Cluj-Napoca, Romania. Overall, cities with highest temperature mortality rates were in Southern and Eastern Europe where the highest temperatures were reached, with these cities benefitting the

most from an increase in tree coverage.

The results of this study support the idea that urban trees provide substantial public health and environmental benefits, however the authors acknowledge that increasing tree coverage should be combined with other interventions to maximize urban temperature reduction (for example, changing ground surface materials to reduce night-time temperatures such as replacing asphalt with trees). Meeting the target of 30% tree coverage can be very challenging for some cities due to urban design, with city average tree cover in Europe currently at 14.9%.

"Our results suggest large impacts on mortality due to hotter temperatures in cities, and that these impacts could be partially reduced by increasing the tree coverage to help cool urban environments. We encourage city planners and decision-makers to incorporate the urban green infrastructure adapted to each local setting while combining with other interventions to maximize the health benefits while promoting more sustainable and resilient cities, especially as we already know that green spaces can have additional health benefits such as reducing cardiovascular disease, dementia and poor mental health, improving cognitive functioning of children and the elderly, and improving the health of babies," says study co-author Mark Nieuwenhuijsen, Director of Urban Planning, Environment and Health at the Barcelona Institute for Global Health.

The authors acknowledge some limitations with this study. The study could not be conducted for a more recent year than 2015, due to unavailability of population data. In addition, a US dataset was used for building the cooling model in the study as opposed to a European dataset. Finally, this study focused on the health impacts of high temperatures but did not look at cold temperature. While cold temperatures currently have greater impacts on health in Europe, health impacts due to heat are projected to exceed those caused by cold under

current emission scenarios, highlighting the importance of adapting our cities now.

Writing in a Linked Comment, Kristie Ebi, University of Washington, U.S., who was not involved in the research, said, "Essentially all heatwave-related deaths are preventable; no one needs to die from the heat. With climate change projected to increase the frequency, intensity, and duration of extreme heat events, communities need to understand the most effective interventions, particularly developing and deploying heatwave early warning and response systems. Equally important are Heat Action Plans that explicitly incorporate the consequences of a changing climate into longer-term urban planning.

"Heat Action Plans detail how to modify urban form and infrastructure to increase the resilience and sustainability of our communities as we face an even warmer future… Encouraging and enabling decision-makers and local communities to develop and implement Heat Action Plan is an effective way to promote climate resilience as soaring temperatures continue to be felt globally. The tools and guidelines are available; the gaps are in human and financial resources for implementation. The time to start is now."

  More information: Cooling cities through urban green infrastructure: a health impact assessment of European cities, *The Lancet* (2023). www.thelancet.com/journals/lan … (22)02585-5/fulltext

  Provided by Lancet