

Exposure to life-limiting heat has soared around the planet

New study shows that periods when extreme heat makes it unsafe to go about daily life are getting longer

By Joe Rojas-Burke, ASU News
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Climate change since the 1950s has doubled the amount of time per year that millions of people around the world must endure heat so extreme that everyday physical activities cannot be done safely, a new study concludes.

“Most heat studies focus on how hot it feels. This one asks a different question: ‘What can a human body safely do in that heat?’” said co-author [Jennifer Vanos](#), an associate professor at Arizona State University in the School of Sustainability.

An important goal of the research is to identify vulnerable populations and regions to help prioritize work to protect people from extreme heat. But the researchers also emphasized the importance of slowing global warming by reducing the use of fossil fuels.

“Unless we stop burning oil, coal and gas, then the constraints on livability caused by extreme heat will only become more common and widespread, particularly as the global population ages,” said first author Luke Parsons of [The Nature Conservancy](#), a non-profit organization in Phoenix.

Over the past 20 years, young adults (those aged 18 to 40) have faced about two times as many hours per year of heat-related “severe livability limitations” as people the same age did from 1950 to 1979, the study found. Adults aged 65 and older experienced about 50% more hours of life-limiting heat than their mid-20th-century counterparts.

The researchers published [their findings](#) on March 10 in the journal Environmental Research: Health.

Unlivable heat

The researchers defined “severe livability limitations” as high temperature and humidity that would limit any activity more strenuous than sweeping a floor in the shade. Instead of relying on simple measures of heat danger, the researchers used a modeling approach to estimate how much

physical activity people of varying ages could perform in different ranges of heat and humidity without their core body temperature rising uncontrollably. Vanos led development of [the physiological model used to assess heat risk](#).

With worldwide records of hourly temperature and humidity measurements from 1950 to 2024, the team calculated how many hours per year heat would limit activity. They overlaid those results with global population data to determine who is most exposed. In some tropical and subtropical regions, heat restricts outdoor activity for older adults for between one-quarter and one-third of the year, the study found.

For healthy younger adults, severe heat limits affect a relatively small portion of the year, though that share is growing. For older adults, the shift is more dramatic. On average, they now face severe heat limits during more than 10% of all hours in a year.

Globally, younger adults were exposed to an average of 25 hours per year of severe livability limitations during the 1950–79 period. That has risen to about 50 hours per year in the 1995–2024 period. Older adults, whose bodies are less able to regulate heat, were exposed to about 600 hours per year of life-limiting heat in the earlier period. That has climbed to about 900 hours per year in the later period.

Hottest hot spots

Southwestern and eastern North America are among the regions with the largest increase in life-limiting heat, along with southern South America, the eastern Sahara region of Africa, much of Europe, Southwest and East Asia, and southern Australia.

In the United States overall, older adults now experience about 270 hours of severely heat-limited conditions per year, up from about 200 hours in the 1950s. Several areas across the South and Southwestern U.S. show hundreds of hours a year of severe limitations.

South and Southwest Asia experience the most hours per year of limitations. In Qatar, for example, younger adults experienced 382 hours per year of severe livability limitations between 1950 and the 1970s. From the mid-1990s to 2024, that figure rose to 866 hours per year, an increase of 484 hours. Exposure for older adults increased by 520 hours to more than 2,820 hours per year over the same period. That means older adults in Qatar now face severe limitations for roughly one-third of the year.

In Cambodia, Thailand and Bangladesh, older adults now experience severe limitations during one-quarter to one-third of the year. Compared with the 1950s, older adults now experience an additional 686 hours in Cambodia, 568 hours in Thailand and 390 hours in Bangladesh. Many people in these countries have limited ability to cope with the heat because of economic or other challenges.

In 2024, the hottest year on record, more than 43% of young adults and nearly 80% of older adults experienced at least some periods when heat and humidity severely limited livability. That's up from 27% and 70% in the 1950s.

Access to cooling, infrastructure and workplace protections can limit exposure to dangerous heat, but access is far from universal, even in wealthy nations such as the U.S.

As world populations grow and age, many more people will face longer periods when ordinary daily activity is unsafe. Regions already hot enough to impose severe heat-related livability limitations, such as sub-Saharan Africa and southern Asia, are also expected to experience rapid population growth, the study authors said.

The researchers noted that widespread livability limitations have emerged with just over 1 degree Celsius of global warming driven by human activity.

“We hope this work motivates rapid emissions reductions to slow global warming and limit future extreme heat impacts,” the authors wrote. “We also hope this work can be used to highlight regions with the most extreme heat risk based on population exposure, vulnerability and heat limitations to target adaptation efforts.”

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Main image



Photo by Samantha Chow/Arizona State University

Text image(s)



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