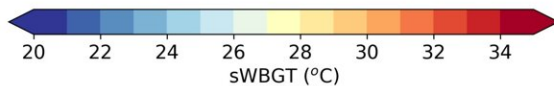
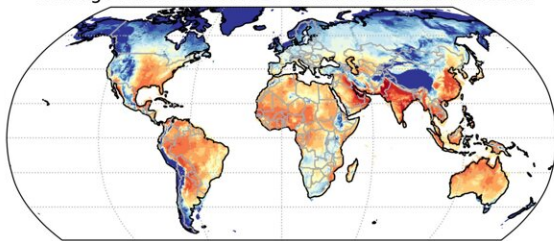


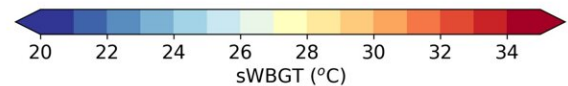
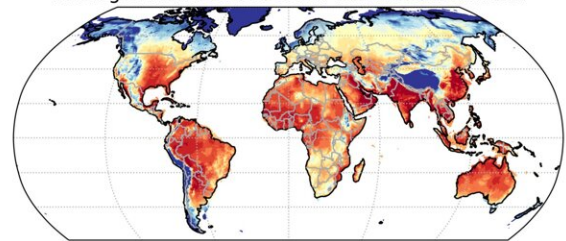
As Earth warms, safe times for outdoor work will shrink

December 15 2021

Climatological Mean (Additional Global Warming: +2°C):
Average Afternoon sWBGT in Warm Season in Shade



Climatological Mean (Additional Global Warming: +2°C):
Average Afternoon sWBGT in Warm Season in Sun



A new Duke-led study finds if Earth warms another 2° Celsius, doing outdoor labor will no longer be safe on summer afternoons in many low-latitude regions, shown here in deep red. Credit: Luke Parsons, Duke University

As heat and humidity levels rise throughout the day because of climate change, options for moving outdoor labor to cooler hours will dramatically shrink, leading to significant worldwide labor losses, a new study led by Duke University researchers finds.

Economic losses associated with this lost productivity could reach up to \$1.6 trillion annually if warming exceeds an additional 2 degrees Celsius relative to the present.

Workers in tropical and [subtropical regions](#), particularly in Asia, the Middle East, Africa and the western Pacific, will bear the worst impacts, the study projects.

"Sadly, many of the countries and people most impacted by current and future labor losses are not responsible for the bulk of greenhouse gas emissions," said Luke Parsons, a climate researcher at Duke's Nicholas School of the Environment, who led the study.

"Many workers in the tropics are already stopping work in the afternoon because it's too hot," Parsons said. "Luckily, about 30% of this lost labor can still be recovered by moving it to the early morning. But with each additional degree of global warming, workers' ability to adapt this way will swiftly decrease as even the coolest hours of the day quickly become too hot for continuous outdoor labor."

If average global temperatures rise by another 2 degrees Celsius—or about 3.6 degrees Fahrenheit—relative to the present, labor losses in the coolest half of the day will exceed current losses in the hottest half, he said. Critical jobs, such as [agricultural work](#) and construction work, will become almost impossible to perform safely during afternoon hours in the summer in many places.

India, China, Pakistan and Indonesia, where larger fractions of the population work outdoors, will experience the biggest losses overall, the study projects, but 14 less populated countries could experience higher per-capita losses. They are: Bangladesh, Thailand, Gambia, Senegal, Cambodia, United Arab Emirates, Bahrain, Qatar, Brunei Darussalam, Ghana, Togo, Benin, Sri Lanka and Nauru.

Parsons and his colleagues published their new peer-reviewed paper Dec. 14 in *Nature Communications*. In it, they project future labor losses for every country worldwide under a global temperature rise of 1 degree

Celsius, 2 degrees Celsius, 3 degrees Celsius and 4 degrees Celsius relative to the present.

"Our analysis shows that if we limit warming to within another degree of current levels, we can still avoid most worker productivity losses by moving heavy labor to the early morning hours. But if warming exceeds 1 degrees Celsius, that becomes much more difficult. It's a sliding curve, it gets exponentially worse as the temperature rises," he said.

The scientists used a blend of observation-based meteorological data and climate model projections of temperature and humidity to estimate humid heat exposure, current labor losses and projected future [labor](#) losses under additional warming.

More information: Luke A. Parsons et al, Increased labor losses and decreased adaptation potential in a warmer world, *Nature Communications* (2021). [DOI: 10.1038/s41467-021-27328-y](https://doi.org/10.1038/s41467-021-27328-y)

Provided by Duke University

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