

Study: Climate change could force outdoor workers to wake up far earlier

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A new study published in *Earth's Future*, a journal of the American Geophysical Union, indicates that if society tries to avoid the economic impacts of climate change on outdoor labor by shifting working hours,

outdoor workers in many regions will need to start working well before dawn at the end of this century to avoid the effect of excessive heat stress.

Outdoor workers are exposed to excessive heat stress, particularly in hot seasons, a trend that is expected to increase as a result of [climate](#) change. This will reduce the capability of physical [labor](#) and eventually cause economic loss.

Shifting working time earlier in the morning, when it is cooler than during midday, can be an effective way to reduce the effect of heat stress. However, the plausibility and efficacy of such an intervention has not been quantitatively assessed on a global scale.

A [research team](#) led by Jun'ya Takakura, a researcher at the National Institute for Environmental Studies in Japan, investigated whether shifting work times can offset the economic impacts of labor capacity reduction due to climate change. The [researchers](#) used a new method to estimate the heat exposure index, and calculated the required amount of time shift necessary to keep the current level of labor capacity in the future.

The results showed that although a time shift was effective to reduce the effect of [heat](#) stress, the required amount of change in working times was not realistic. The expected start time for outdoor workers would be well before dawn unless stringent climate-change mitigation was achieved.

Under the highest greenhouse-gas emission scenario, the required shift globally was 5.7 (4.0–6.1) hours on average by the end of this century. The current social system would not allow such a drastic working time shift to come into practice, according to the study's authors. It is also known that shifting working time can cause other harmful effects such

as circadian rhythm disorders.

The research team also conducted an economic simulation, and found that residual damage due to labor capacity reduction would be 1.6% (1.0-2.4%) of global total GDP if the time shift is limited to a realistic range of up to three hours.

"This study is based on somewhat simplified assumptions, but it can provide us useful insights to respond to climate change. It is obvious that up to around six hours of working time shift is unrealistic and we need to find alternative ways to adapt to climate change," Takakura said. These options include mechanization of physical labors, body cooling, reforming of the industrial structure and so on.

"Perhaps most importantly, climate change mitigation by reducing greenhouse gas emissions certainly contributes to alleviating the challenges to adaptations," he added.

More information: Jun'ya Takakura et al. Limited Role of Working Time Shift in Offsetting the Increasing Occupational-Health Cost of Heat Exposure, *Earth's Future* (2018). [DOI: 10.1029/2018EF000883](https://doi.org/10.1029/2018EF000883)

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